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THE INFLUENCE OF ARTEMISIA ABSINTHIUM ON NEIGHBOURING PLANTS

(An essay of Experimental Plant Sociology No. III)

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1. Introduction.

In 1939 Bode (2) published a paper on the influence of foliate excretions of *Artemisia Absinthium* on neighbouring plants. He stated that seedlings of *Foeniculum vulgare* and other species were hindered in their development when grown in the proximity, that is within 1 m of absinth plants; at a distance of 130 cm and further the development was normal. The leaves of *Artemisia Absinthium* bear glandular hairs which excrete ethereal oils and the alcaloid absinthiin; the latter substance is probably the main cause of the scanty growth of neighbouring plants. It is specially formed during dry, hot weather and appears in numerous droplets on the surface of the hairs, easily perceptible under the microscope. When a shower occurs a considerable part of it is washed away and spread on the vegetation nearby with the consequence above mentioned. The production is specially intense in the small leaves which are formed at the top of the plants towards the time of flowering and their inhibiting influence, therefore, is most marked at this stage. I may refer to Bode for a detailed description of the anatomy of the hairs and their excretion, and for many particulars about the chemistry and other characteristics of the substances produced.

Fröschel and the present author having taken some steps in the new field of experimental sociology (7, 8a-b), Bode's observations were of special interest to us; it was our intention to make experiments based thereupon, but as circumstances temporarily prevented us from collaborating I have continued our work alone in the way which will be described here.

2. Experiments at Leiden, 1941.

A hedge, 4 m long, of *Artemisia Absinthium* was planted in the Botanical Garden at Leiden; the material was taken from plants a few years old in the "Clusius Garden". The hedge was placed in an approximately West—East direction in order that the test species could be sown at the northern and at the southern side of it. In doing so any influence of factors such as sunshine, shade, etc. could be distinguished from that exerted by the absinth plants. The experiment was made on a plot of limy, rather poor garden soil, but as *Artemisia* itself as well as the chosen test species are not used to rich nutrition, this means no great impediment if at all; it appeared indeed that the development of the test plants, as far as they were outside the range of influence of the absinth, and that of the latter itself was perfectly normal, notwithstanding the fact that no manure was given. Competition for food may also be considered as negligible because none of the species used possesses an extensive root system. The experiments made at Lisse in 1942 have, amongst others, fully confirmed this assumption. The plot which was available for the experiment offered one disadvantage, viz. that it is surrounded by trees, so that the plants received full sunshine only during a restricted number of hours per day. The climate in 1941 was not very favourable; we had a spell of hot, dry weather from the middle of June till July 29th; during this time the peculiar smell of the absinth leaves was strong, an indication of their high content of alcaloid. Before and afterwards low temperatures and heavy rains prevailed; the leaves smelled faintly. Bode measured the excretion throughout the season and has indeed demonstrated that during a rainy period it sinks to a very low level. In spite of these factors, moderately contributory or even distinctly unfavourable, results were satisfactorily convincing.

The hedge was planted in the end of March. Owing to the cold spring its growth was slow, but on May 27th it had reached a height of 40 cm and on that day a number of test species were sown beside it, each in one or two rows of 1½ m long, perpendicular to the hedge, and this on both N. and S. sides. Thinning, spraying, etc. took place whenever it was necessary. The absinth plants lengthened rapidly during June to a height of ± 115 cm and started flowering towards the end of that month; consequently they formed most of their alcaloid exactly during the time when conditions for its production were favourable. The seedlings of May 27th, therefore, underwent the proximity of the absinth plants to the full during the first weeks of their growth and the results became soon visible. Other species were sown later in the season, when the weather was much less fine, and therefore they showed the influence of the absinthiin to a lesser degree and at a later stage of their development.

I will now briefly summarize the results obtained with the different test species.

Artemisia Absinthium. Sown in April; seedlings of 2 cm high were planted beside the hedge on May 20th; on July 25th they had reached a height of 35 cm and were cut near the soil; they started growth anew till the end of the season. No influence from the older plants in the hedge could be detected; the rows were equal in height over their whole length.

Salvia sclarea. Bode mentions that this species is sensitive to the absinthiin. It was sown on May 27th; the seedlings appeared on June 6th. On June 26th samples close by the hedge were distinctly smaller than those which were further away from it; the differences accentuated gradually, especially on the S. side. On July 28th the diameter of the rosettes on this side was as follows: at a distance between 150 and 75 cm from the hedge: 30 cm; within this distance it diminished to resp. 15, 12, 7, 3½, 2½ cm; those not farther away from the absinth plants than ± 40 cm, therefore, showed regular dwarf forms. The same held true

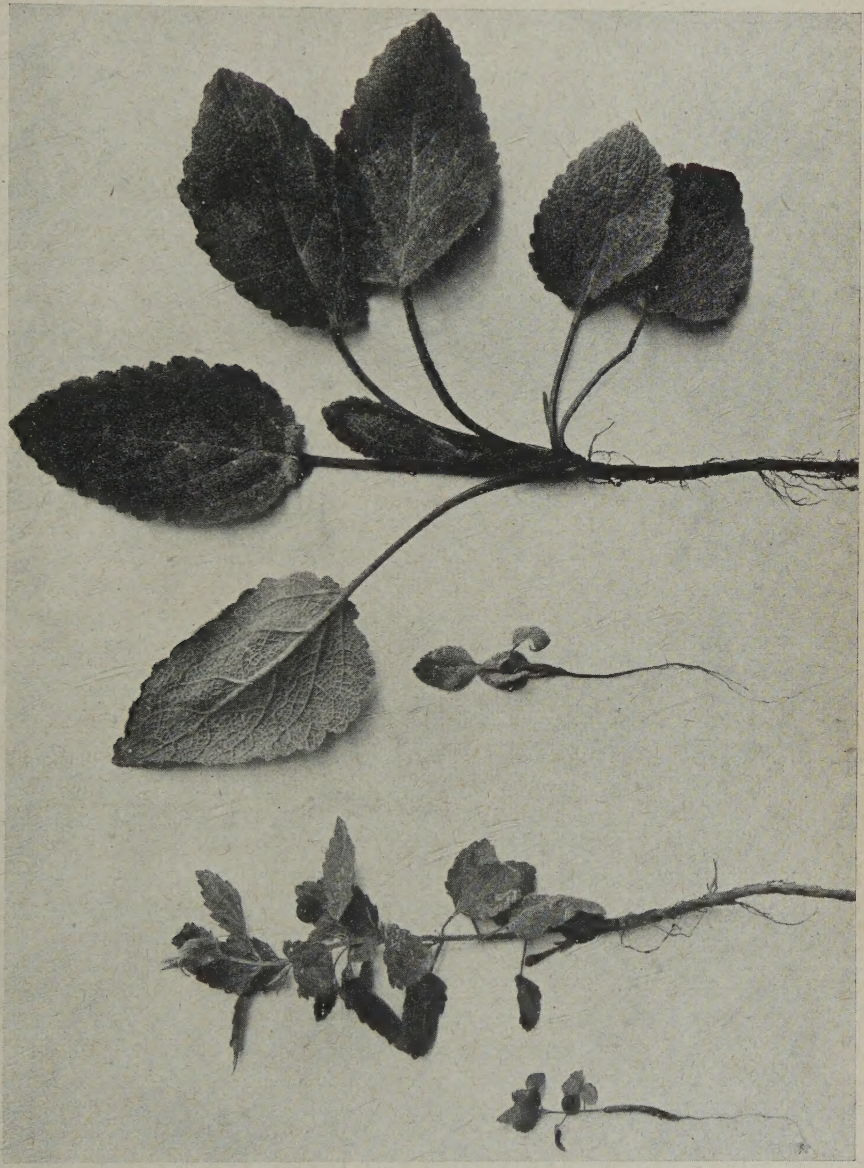

Fig. 1 — *Nepeta nuda* (l.) and *Salvia sclarea* (r.); resp. at distances of 40 cm (l.) and 120 cm (r.) from *Artemisia Absinthium*; 8 Aug. 1941.

for the specimens on the N. side, but here the inhibitory effect of the absinth plants was only felt within a distance of 50 cm. Two specimens on the S. side, grown resp. at 120 and 40 cm from the hedge, were photographed on August 8th; see *fig. 1.* Table I gives an impression of the dimensions of the rosettes and the leaves on different data.

Levisticum officinale, Nepeta nuda, Carum bulbocastanum and *Lepidium sativum* were also sown on May 27th; their development and the influence of the absinth plants on it were much the same as in the case of *Salvia*; a detailed description, therefore, is superfluous; see the data in Table I and *fig. 1* (*Nepeta*) (Bode examined *Levisticum officinale, Carum Carvi* and *Nepeta cataria*). It is noteworthy that *Levisticum* was injured by the absinth to such a degree that on the S. side of the hedge the plants died up to 75 cm from it; the measurements are therefore given of specimens on the N. side.

Tagetes erecta nana, Zinnia Haagaana and *Calendula officinalis* were sown on July 17th; the fair weather ceased soon after that and consequently the production of absinthiin was scarce. These species, therefore, developed normally in the beginning; their specimens close by the hedge were equal in size to those at the greatest distance. This proves that the competition for food between the absinth and the test plants may be considered as of no importance. It was only in the course of September that the influence of the absinth became clearly visible; the specimens nearest the hedge remained small, their flowers were scanty and hardly opened, their stems were not ramificated; further particulars will be found in Table I.

We see that every species of test plant, with the exception of *Artemisia Absinthium* itself, underwent the influence of the alcaloid to more or less the same degree; this action made itself felt after a longer or shorter period according to the weather, but the final result was principally the same in every case.

In the end of July a number of specimens of *Salvia, Nepeta, Carum* and *Levisticum,* which had grown close by the hedge, were replanted to a place far outside the sphere of the absinth plants. During the ensuing months they recovered partially from the injurious influence of the alcaloid, but at the end of the season they still stayed far behind those specimens which had grown in normal conditions from the beginning. Not until 1942 they reached their full development. The same can be said about the specimens which were kept during the winter in the rows beside the hedge; in the autumn of 1941 they were cut at their base, as well as the absinth plants themselves; they all survived the severe winter 1941—42 and in the following spring they resumed growth, *Artemisia* last of all. The four test species very soon outgrew the plants in the hedge and started flowering without showing the least trace of impediment exerted by the absinth. They were then removed because I needed their space for other experiments. We see therefore that seedlings can be injured very considerably by the proximity of absinth plants, that they can be even killed by it (*Levisticum*), but that once they have survived its influence they can keep their ground.

TABLE I.

Development of the test species beside the hedge of *Artemisia Absinthium.*

Species	Date	Development at distances of 120 and 40 cm from the hedge; (dimensions in mm)		
			120 cm	40 cm
Salvia sclarea	28/7 –'41	diameter rosettes	300	70
	20/9 –'41	— —	600	120
	4/10–'41	length of petiole	210	20
		length of leafblade	155	30
Carum bulbocastanum	4/10–'41	height of plants	370	125
		length of leaf	270	90
Levisticum officinale	4/10–'41	length of main petiole	150	72
		length of top leaflet	40	25
Nepeta nuda	4/10–'41	height of plants	290	70
		length of leafblade	40	14
Lepidium sativum	14/7 –'41	dry weight per spec.	650 mg	190 mg
Tagetes erecta nana	4/10–'41	height of plants	455	240
		flowers per spec.	5—6	1
Zinnia Haagaana	16/9 –'41	ramification	normal	none
		flowers per spec.	4—5	1
Calendula officinalis	23/8 –'41	flowers per spec.	3—4	1
Perilla nankinensis	10/8 –'42	height of plants	320	60
		length of leaf	135	25
Dianthus barbatus	10/8 –'42	height of seedlings	70	22
Pisum sativum	31/8 –'42	height of plants	225	130
Hyssopus officinalis	14/8 –'42	height of plants	280	110
		ramification	normal	none
Linum usitatissimum	14/8 –'42	height of plants	460	240
Lavatera cretica	10/9 –'42	height of seedlings	150	75
		breadth of leafblade	44	19
Cheiranthus Allionii	10/9 –'42	height of seedlings	50	19
Dahlia variabilis	10/9 –'42	height of seedlings	150	70
		length of petiole	80	35
		length of leafblade	50	22
Iberis coronaria	10/9 –'42	height of plants	100	60
		length of petiole	36	14
Lysimachia punctata	10/9 –'42	height of seedlings	160	80
		length of leafblade	52	21

3. EXPERIMENTS AT LEIDEN, 1942.

The climate in 1942 was still much worse than in 1941. We had fine weather on July 3rd and 5th, but apart from these exceptional days low temperature and much rain prevailed throughout the first months of the summer season. The production of absinthiin, therefore, was without doubt very scanty (comp. Bode) and we need not wonder that the results in the beginning of the summer were on the whole negative. This was a. o. the case with *Foeniculum vulgare, Iberis coronaria, Pisum sativum, Phaseolus multiflorus, Phacelia tanacetifolia, Lathyrus Clymenum, Linum austriacum*; their development was equal, no matter whether they grew close by the hedge or at a distance from it. We shall see later on that this does not mean that they are insensitive to the absinthiin, but that it is really the lack of production of the alcaloid which is responsible for their undisturbed growth. That *Carum, Levisticum, Nepeta* and *Salvia* overcame the influence of the absinth plants in their second year is perhaps a fact which would have occurred anyhow, but on this occasion they were certainly helped in doing so by the weather conditions which, though unfavourable in themselves, overbalanced the otherwise still greater impediment of the alcaloid.

The results of 1941 were practically accomplished in the end of July; at the same time in 1942 hardly anything of this kind was to be seen yet. Therefore I sowed a number of species on August 3rd, some of them for the second time: *Pisum sativum* (2nd time), *Iberis coronaria* (2nd time), *Dahlia variabilis, Cheiranthus Allionii, Lavatera cretica. Hyssopus officinalis* (May 27th), *Lysimachia punctata* (May 27th) and *Linum usitatissimum* (June 17th), sown on the data mentioned after their names, were kept throughout the summer. The weather in August and September was a little better than during the foregoing months; notwithstanding this the species sown on August 3rd and *Lysimachia* did not develop beyond the seedling stage; but nevertheless the action of *Artemisia* became appreciable and gradually differences comparable to those observed in 1941 were visible in all species mentioned. Particulars about each of them will be found in Table I; these are sufficient to demonstrate that even in highly unfavourable conditions the action of the absinthiin can make itself felt and very distinctly so.

4. EXPERIMENTS AT LISSE, 1942.

I wanted to make perfectly sure that the influence of absinth plants on others is not illusory and therefore I repeated my experiments in different surroundings, viz. on the ground of the Laboratory for Bulb Research, Lisse near Leiden, where we find the soil characteristic for the bulb district along the foot of the dunes. The plot of ground put at my disposal was open to all winds and without any shade. Therefore the circumstances were widely different in many respects from those in the rather enclosed area at Leiden. In these conditions, moreover, the bad weather of 1942 made its influence doubly felt as was seen by the extremely slow development of all plants.

Besides this I extended the experiments to other species whose action on neighbouring plants was to be investigated, viz. *Artemisia vulgaris* and *Atriplex hortensis.* The former excretes ethereal oils, though not so much as *Artemisia Absinthium* and of different composition, and no absinthiin (3, 10, 14); the latter may be considered as perfectly "neutral", but is about the same height as the *Artemisia*'s and gives the same density of shade; it is, moreover, a nitrate plant, the food competition of which must be considerable. For the rest the experiment was carried out in the same way as those in Leiden, hedges of 4 m long in a E—W direction and on both sides rows of test plants, 2 m long and perpendicular to them. It goes without saying that the same test species were sown beside everyone of the hedges. I chose as such in the first place some of the species which in 1941 had proved to be very sensitive to the absinthiin, viz. *Salvia, Nepeta, Carum* and *Levisticum,* further *Linum usitatissimum* (which was also investigated in Leiden), *Dianthus barbatus* and *Perilla nankinensis.*

The hedges of both species of *Artemisia* were planted in the end of March; *Atriplex* was sown on April 16th. On June 2nd the *Artemisia*'s were only ± 30 cm high, of *Atriplex* a small number of seedlings were visible; therefore I sowed it a second time. Later on in the summer these plants as well as the *Artemisia*'s grew better and formed hedges of a height of ± 1 m (*Art. Abs.*) to ± 2 m (*Art. vulg.* and *Atriplex*).

The test species were sown on June 2nd and 18th. Except *Nepeta* which germinated irregularly, they grew well but very slowly and until the end of July they did not develop beyond the seedling stage. It was only in the beginning of August, when the hedges had reached a considerable height, that dwarf forms became visible in the specimens growing next to the absinth plants; these deviations became accentuated and in September they were as considerable as those which were observed in the experiments at Leiden; I refer to Table I for particulars. The results with *Salvia, Carum, Nepeta* and *Levisticum* are especially valuable because they confirm fully those of 1941. *Linum usitatissimum* presented identical phenomena at Leiden and at Lisse.

The test species sown besides *Atriplex* showed no deviation at all; the specimens close by the hedge, even those at the northern side of it, were exactly of the same height and general habitus as those at the greatest distance. Notwithstanding food competition, shade, etc., *Atriplex* appeared to exert no influence on the neighbouring flora. The same can be said about *Artemisia vulgaris,* but for a complication of secondary importance. Towards the end of July these plants had developed so abundantly and their side branches were so spreading and laid by the wind, that part of them had to be cut away and the others were tied up. It then appeared that they had oppressed the specimens of the test species growing under them, so that up to a distance of 60 cm from the hedge the test plants were very small, but those farther away from it were all full sized and there was no transition between these two groups. This fact demonstrates clearly that there is no question of any chemical action of *Artemisia vulgaris.* Beside the absinth plants, on the contrary, the aspect was quite different: there was a gradual decrease in height as the plants stood nearer the hedge; between the tallest and the smallest there was at least a distance of 50—60 cm, whereas in the case of *Artemisia vulgaris* it was hardly 10 cm. The flax showed this best of all; I measured the height of the slender, unbranched stems in every decimeter of the rows and obtained data which could be plotted without any further arrangement. The 3 graphs, combined in *fig. 2,* show very clearly the chemical oppression exerted by *Artemisia Absinthium,* the physical oppression of *Artemisia vulgaris* and in the case of *Atriplex hortensis* no oppression at all.

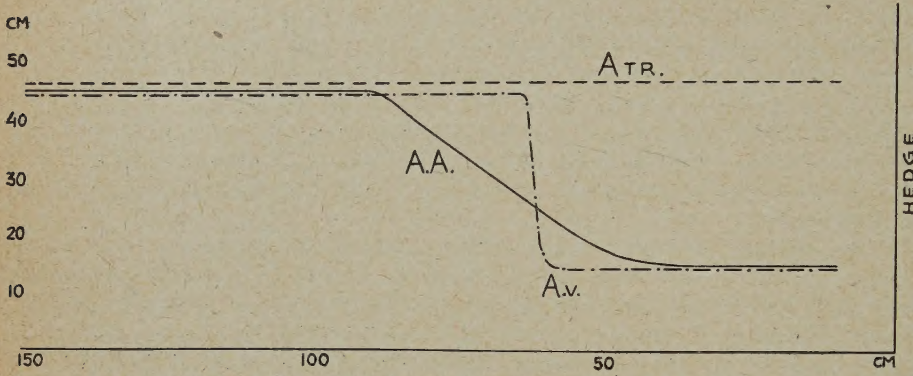

Fig. 2 — Height of *Linum usitatissimum*; 26 Aug. 1942.

——————— beside the hedge of *Artemisia Absinthium* (chemical oppression).
—·—·—·— „ „ „ „ *A. vulgaris* (physical oppression).
— — — — — „ „ „ „ *Atriplex hortensis* (no oppression).

The results obtained at Lisse and Leiden justify the conclusion that the injurious action of *Artemisia Absinthium* on neighbouring plants is due to its secretion and most probably to that of absinthiin.

5. THE INFLUENCE OF ABSINTH LEAVES IN THE SOIL ON GERMINATION AND DEVELOPMENT OF SEEDLINGS.

Bode stated that fresh or pulverized leaves of *Artemisia Absinthium,* dug in the soil where *Foeniculum* has been sown, reduce and retard the germination and inhibit the development of this plant. I extended this experiment to several other species. *Pisum sativum* and *Phaseolus multiflorus* were sown in open soil mixed with fresh absinth leaves, which were cut into small pieces; the results are recorded in Table II.

The retardation in the germination of *Pisum,* though considerable, lasted only a few days. The seedlings were smaller than those in the control, but these arrears too disappeared gradually until on August 11th they were no longer visible. *Phaseolus* appears to be much more sensitive to the absinth leaves; not only the percentage of germination never reached that of the control, but the development too was less vigorous and many of the plants kept an abnormal habitus, rolled up or undulated leaf blades, and did not recover, so that even in the middle of October the differences were still as distinct as in August. It is worth while

TABLE II.

Germination % with and without foliage of *Artemisia Absinthium* in the earth.

Date	*Pisum sativum*		*Phaseolus multiflorus*	
	Control	with fol. of *A. A.*	Control	with fol. of *A. A.*
25/7–'41	sown		sown	
31/7	89	3½	0	0
1/8	95	52	0	0
2/8	100	86	32	0
4/8	100	100	93	14
5/8			100	36
6/8			100	46
7/8			100	54
11/8			100	61
21/8			100	75
15/10			100	75

to recall the fact that in 1942 the absinth plants did not exert any influence on the beans, most probably because their production of absinthiin was checked by the bad weather; this sowing experiment shows that *Phaseolus* is by no means insensitive to the alcaloid.

In 1942 I continued these experiments with the species mentioned in Table III. Equal quantities of their seeds were sown in shallow square

TABLE III.

Germination with and without foliage of *Artemisia Absinthium* and *A. vulgaris* in the earth.

Species	Days	Control	*A. vulg.*	*A. Abs.*	Development
Cheiranthus Allionii	7	253	86	85	with *A. A.* small
	14	289	87	113	equal
Dianthus barbatus	7	241	152	60	with *A. A.* small
	14	282	191	135	equal
Lathyrus Clymenum	9	88		35	equal
Lathyrus magellanicus	4	22	20	12	
	23	26	29	23	with *A. A.* small
Levisticum officinale	13	28	30	16	
	15	35	38	30	with *A. A.* small
Linum austriacum	11	62		28	
	14	114		39	equal
Linum usitatissimum	9	152	153	110	equal
Perilla nankinensis	9	30	22	9	
	15	75	63	50	equal

bowls, in plain earth and in earth mixed with fresh leaves of resp. *Artemisia Absinthium* and *A. vulgaris*; the former ones had but a faint smell. The seedlings were counted every day; only the essential data are recorded in the table. These results, as well as those of 1941, tally well with what Bode observed in his experiments with *Foeniculum.* We see that in every case the germination is most rapid in plain earth, although it can catch up to some extent in the other bowls. The rate of development is not nearly so much influenced as the percentage of germination, but whenever this happens to be the case, the strongest inhibition is seen in the earth with absinth foliage. Bode observed a tendence to succulency amongst other phenomena in the plantlets of *Foeniculum*; I never detected anything similar.

When we compare the germination in the bowls with the foliage of *Artemisia Absinthium* and *A. vulgaris,* we see that, except in the case of *Cheiranthus,* the absinth leaves are the most injurious. *A. vulgaris* is by no means without influence, though; its retarding action is perhaps due to the ethereal oils, but this seems not very probable, witness the fact that in the field experiments no chemical influence of this plant on other species could be detected. It is therefore more probable that the inhibition of the germination must be ascribed to causes which will make themselves felt whenever there is a great quantity of organic manure in the soil; a high concentration of CO_2 will be one of the first among them. The same may hold true for *Artemisia Absinthium*; that absinth foliage does have an unfavourable effect on the germination of other species appears to be a fact, but as long as we do not know what exactly the action of absinthiin or other substances excreted by *Artemisia* is, added in pure condition to the soil, it is too risky to draw any conclusions from my experiments. It was my intention to spray the seedlings with infusions of absinth leaves; I awaited a sequel of fine summerdays for this purpose, but in vain.

Attention may be drawn to the fact that of all species investigated *Lathyrus Clymenum* and *Linum austriacum* are most strongly inhibited in their germination by the absinth foliage. In the early summer of 1942 they were also planted beside the absinth hedge and not injured at all because the amount of alcaloid produced during that spell of bad weather was not sufficient to assert itself; this case, therefore, is parallel to that of *Phaseolus.*

The foliage which remained on the plants of *Artemisia Absinthium* and *A. vulgaris* in the end of the autumn 1942 has been collected and dug under in reserved plots; next spring we will sow species on them which have appeared to be very sensitive to the fresh foliage in the soil; possible positive results may be of some ecological value.

Apple air has a strong influence on various life phenomena of plants, owing to its content of ethylene. Defoliation and chemonastic movements of the leaves are among the most conspicuous and rapid responses (9, 12). Species which in former experiments have proved to be extremely, sensitive in this respect, e. g. *Mimosa pudica,* were put under glass bells together with strongly smelling branches of *Artemisia Absinthium*; the alcaloid appeared to exert no influence whatever under these circumstances.

6. DISCUSSION.

Bode made the following experiment: 5 g of dry leaves, taken from the top of the absinth plants, were put in water; the cut surface of the petioles remained in the air, so that only substances excreted by the intact hairs on the leafblades could dissolve in the water; the surface of the lamina itself remains dry. After 10 minutes the leaves were removed, the water showed a yellowish tint and after evaporation there remained a dark brown residue weighing 130 mg. I repeated this experiment on hot, dry days in the summer of 1941, when the weather had been fine for a number of days in succession, in other words when conditions for the formation of absinthiin were at their best. I never obtained more than 48 mg of residue; the secretion is apparently much stronger in the continental climate of Geisenheim a. Rh. where Bode made his observations, than in the sea climate of Leiden. This is what one might expect according to the evidence yielded by the researches of de Saussure (13), Arens (1) and Lausberg (11). When, moreover, we bear in mind that on the whole the circumstances during the two last summers were extremely unfavourable for the production of the alcaloid, we can only wonder that the results have been as they were. Arens, Bode a. o. emphasize the empirical fact that drug plants should be harvested during dry, hot weather and never immediately after rain; they give several examples of species which are known to lose their active substances as soon as they are wetted by dew or otherwise (*Datura, Hyosciamus, Chelidonium*).

Artemisia Absinthium is a plant characteristic for a continental climate and in its habitat it cannot but exert a considerable influence on the neighbouring flora. Since I have never had occasion to observe it in its natural surroundings, I will be pleased to receive any information on this point. There was something which I could see myself, though, viz. in the nursery of medicinal plants of mr. A. C. Caspers at Noordwijk-Binnen. A field of two years old *Thymus vulgaris* bordered on the S.E. side of one of *Artemisia Absinthium.* The thyme was planted in rows, the three outward ones of which were at distances of resp. 40, 80 and 120 cm from the absinth. In the end of August 1942 I could observe that the first row had developed extremely poorly; especially where the soil was clayish most specimens had altogether disappeared; those which had survived where very small and many showed a sickly yellowish colour; from this row no appreciable harvest was obtained. The second row looked considerably better, yet was far from being normal; only the third row had remained free from the action of the absinthiin and was similar to the following ones. The distances at which the absinth plants made themselves felt here tally well with those in Bode's and my experiments. Another plot of thyme, sown in 1942, bordered on the N.W. side of a field of *Artemisia Absinthium*; although the distance between the species was 40 cm in this case too, no action of the latter on the thyme could be observed; this seemed the more remarkable because in my experiments it were precisely the seedlings which felt the influence of the alcaloid most strongly. Mr. Caspers ascribed this apparent inconsistency to the prevailing wind which in this particular place comes from a northwestern direction.

A three year old crop of *Levisticum*, S.E. from an absinth field, was not injured by it; this tallies with my experience.

The weed vegetation in the absinth crop reacted very differently to it: *Stellaria media, Atriplex hortensis* and *Datura Stramonium* (migrated from a neighbouring field) grew as well as anywhere, but *Senecio vulgaris* was distinctly oppressed.

It goes without saying that what I saw in this nursery is communicated here by way of suggestion only; but I venture to add that these suggestions may prove to be valuable for further research.

Inventory of square meters in a region where *Artemisia Absinthium* occurs, must needs strongly vary according to whether it is present in the examined area or not.

Up till now Bode is one of the very few who have investigated the chemical action of a phanerogamic plant on others in its natural surroundings; the influence of emanations of plants on other species has often been studied under bell jars (4, 5, 9, 12), but this sort of research can hardly give an impression of their ecological significance. That these emanations occur in endless variety has long been known; that they are of higher ecological importance than many botanists up till now were inclined to acknowledge (6), was made clear by the work of Arens and Lausberg. Plant ecology and sociology should certainly reckon with this fact; for further discussion on this point I may refer to the literature cited elsewhere (8 c-d).

7. SUMMARY.

Eighteen species of plants, most of which were chosen at random, were sown beside a hedge of *Artemisia Absinthium*; they were severely injured and in one case (*Levisticum officinale*) even killed by the chemical excretions of the latter within a distance of ± 100 cm; seedlings of *Artemisia Absinthium*, on the contrary, were not harmed by the plants in the hedge. The experiments were made during two successive summers and in different surroundings; the results were consistent and confirmed those of Bode, notwithstanding the fact that climatic conditions were extremely unfavourable for the excretion of absinthiin and that even during fine weather it appeared to be feeble owing to the sea climate of Leiden. Spells of cold and of heavy rains sometimes kept the excretion so low that temporarily the absinth plants seemed to exert no action at all.

Seedlings which had survived the proximity of the absinth in their first year developed normally during the next season.

It was demonstrated that the proximity of *Atriplex hortensis* had no influence on the same test plants which were injured by *Artemisia Absinthium* and that they were only physically oppressed by *Artemisia vulgaris*, viz. by its spreading branches. This makes it probable that it is indeed the absinthiin, excreted by *Artemisia Absinthium*, which causes this species to be harmful to the surrounding plants.

Fresh leaves of *Artemisia Absinthium*, dug in the soil, reduced the percentage of germination and sometimes also hindered the development of the seedlings of a number of species. Foliage of *Artemisia vulgaris* had sometimes a similar action, but seldom to the same degree. In the case of *A. Absinthium* two harmful effects are apparently combined: a too great amount of organic manure and the formation of absinthiin.

It will be worth while to examine the ecological importance of *Artemisia Absinthium* in its natural habitat.

I want to express my heartfelt thanks to everyone in the Botanical Institute and in the National Herbarium at Leiden who helped me to carry out these researches.

I feel greatly indebted to the Director and the staff of the Laboratory for Bulb Research at Lisse who very kindly enabled me to extend my experiments.

Leiden, Botanical Institute. November 1942.

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THE INFLUENCE OF SATUREJA HORTENSIS L. ON ALLIUM CEPA L.

(An essay of Experimental Plant Sociology No. IV)

by

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In the famous herbal of Rembert Dodoens I noticed the following remark in the chapter on "*Cepa rotunda*" (*Allium cepa*): "Somtijdts set men se alleen in bijsonder beddekens; somtijdts saeyt men se met andere moescruyden / als met Lattouwe; maer den selven Palladius houdt voor best / dat men se met de Satureye oft Keule saeyt / om dat se soo beter aerden ende voortkomen / als Plinius betuyght." ("Cruydtboeck", ed. 1618 or 1644, pag. 1073; see also A. Schierbeek, "Bloemlezing uit het Cruydtboeck van Rembert Dodoens", 1941, pag. 139) (Sometimes they are planted by themselves in special beds; sometimes they are sown together with vegetable herbs as e. g. lettuce; but the said Palladius considers best to sow them together with the savory because thus they thrive and develop better, as Pliny attests.) In Pliny's "Historiae Naturalis Libri XXXVII" I found only the following words concerning this question: "Intermisceri satureias, quoniam melius proveniat." (Lib. XIX, cap. 32). The reference to Palladius bears most probably on the "De Re Rustica Libri XIV" (Leyden, 1541) by this author, but I had no opportunity to verify this myself.

Savory has been cultivated as a condiment since many centuries; already Pliny mentions it as such and therefore it may be taken for granted that the "satureye" meant here is identical with our *Satureja hortensis* L., although we have no absolute proof for it (Plinius, Lib. XIX, cap. 50; C. Bauhin, "Pinax", 1623, p. 218; R. Dodoens, "Cruydtboeck", 1644, p. 465; C. Linnaeus, "Species plantarum", 1753, p. 568; C. Pickering, "Chronological history of plants", 1879, p. 470).

In order to verify the assertion of Pliny and Dodoens I sowed *Allium cepa* ("Rijnsburger gele") on three plots of one square meter each; this took place on May 11th, 1942. On one of those plots (I) savory was sown simultaneously; on another the same quantity was sown after the onions had germinated, viz. on June 1st (II); on the third the onions remained alone (III). The onions germinated readily on all three plots. The same can be said of the savory on plot I and this latter species had to be thinned four times during June and July in order to keep the number of its specimens more or less equal to that of the onions. On plot II the germination of the savory was slow and the number of plantlets remained far below that on plot I. I estimated roughly that on 3 onions there was not more than 1 specimen of savory; their development, moreover, was less vigorous and they produced only a small number of flowers, whereas those on plot I were in full flowering since the middle of August. I see no reason at hand why the savory on this plot showed such a poor growth but for the presence of the onions themselves. Plots II and III got more shade from a tree nearby than I; the latter, therefore, was in slightly better conditions, but for the rest these were equal for all three.

Since the end of July it became clear that the onions developed best on plot III, where they grew alone, and least on plot I; plot II was intermediate between the others. They were harvested on September 29th. The number of plants and other particulars are recorded in the following table.

	number of plants	weight of plants	number of bulbs	% plants with bulbs	weight of bulbs	weight per bulb
onions sown simultaneously with savory	214	305 g	109	51	125 g	1.15 g
onions sown 3 weeks earlier than savory	246	535 g	146	59	208 g	1.42 g
onions alone	236	1100 g	139	59	342 g	2.46 g

This table shows that the number of plants developed is practically equal on each plot; the same holds true approximately for the percentage of specimens which have formed bulbs. The rate of growth, however, differs widely according to the presence or absence of the savory. This species appears to have exerted a most injurious influence on the onions, on the organs above ground as well as on those below. The differences are greatest between plots I and III, but they become of special interest when we compare II and III. On plot II the onions had a 21 days start on the savory; the latter, moreover, developed poorly. One could imagine that on plot I the composition for space and light had prevented the onions from full development, although the continuous thinning of the savory and the tenuous habitus of this species make this supposition unlikely; this holds the more for plot II, where, moreover, conditions for the onions were a little more favourable than on III as has been said above. There is still another point to be considered: owing to the small number of savory plants which developed on plot II, their distribution was unequal with the consequence that in some places on this square meter, groups of onions grew without any specimen af savory among them and these were on the whole as tall as those on plot III (this occurred even on plot I); the others, however, were so injured by the proximity of the savory that the average of plot II remained considerably below that of plot III.

These preliminary results indicate that, quite contrary to the ancient idea, *Satureja* is harmful to onions (and *vice versa?*) and the question arises what is the cause of its deleterious action (and whether other species are sensitive to it). B. L. Hartwell (Jour. Am. Soc. Agron., **19**, 255—259, 1927) reports that preceding crops injurious to onions are those which are physiologically acid because they remove more cations than anions from the soil (mangels, cabbages, rutabagas). This injury can be corrected by the use of lime and phosphate fertilisers. The soil on which my experiment was done was rather rich in lime and the year before a small number of peas and beans had been grown on it. It is hardly acceptable that these plants should have caused such acid conditions as to injure the onions to the degree I observed; moreover, if this were true, the effect ought to be perceptible on plot III as well as on I and II, and we saw that this is far from being the case. The possibility remains that savory is a physiologically acid species, but the results on the limy soil, and especially those on plot II, make this very unlikely.

Although we may be satisfied that our *Satureja* is identical with that of Pliny, it is possible all the same that I used a variety unknown to him; the same holds true for the onions. A botanist had better leave it to historians and philologists to solve this problem; for us the facts remain which have been mentioned here and these point to the possibility that there really exists some sort of (reciprocal?) antagonism between the savory and the onion, the nature of which is worth while to be examined more thoroughly.

SUMMARY.

Contrary to what Pliny and Dodoens assert, *Satureja hortensis* appeared to be very deleterious to onions when these species were sown together.

Leiden, Botanical Institute. November 1942.

ORCHIDACEAE NOVAE MALAYENSES XVII *) 1).

by

J. J. SMITH

(Oegstgeest).

(Issued April 15th, 1943).

Habenaria baliensis J. J. S., n. sp.

Planta florens 62—72 cm alta. Caulis inferne vaginatus, ceterum foliatus. Folia c. 8, lineari-lanceolata ad linearia, breviter acuminata ad sensim acutata, acuta, sicco membranacea, 12.5—14 cm longa, 1.8—1.1 cm lata, superiora decrescentia et sensim in bracteas vergentia; vaginae inferiores longe tubulosae, superiores 0. Inflorescentia sublaxe vel subdense multiflora, glabra, rachide 12—18 cm longa. Bracteae majusculae, oblongo-ovatae, sensim longe acuminatae, acutae, concavae, c. 2.4 cm longae, 0.8 cm latae. Flores erecto-patentes, inferiores c. 2.3 cm longi. Sepalum dorsale cum petalis galeiforme, ellipticum, vix ovatum, apice leviter contractum, obtusum, basi vix contractum, concavum, 3-nervium, costa media dorso prominula, c. 0.8 cm longum, 0.4 cm latum. Sepala lateralia oblique elliptica, leviter sigmoidea, apice contracta obtusa et irregulariter marginata (minute crenulata), basi contracta, concava, 3-nervia, c. 0.85 cm longa, 0.35 cm lata. Petala oblique oblonga, margine interiore leviter sigmoidea, paulo inaequilatera praesertim versus basin, obtusa, 2-nervia, c. 0.75 cm longa, 0.25 cm lata. Labellum 3-partitum, calcaratum, usque ad apicem laciniae intermediae 1 cm longum, lamina reflexa, ungue gynostemio adpresso costulis 3 longitudinalibus convexis instructo bene 0.1 cm longo, laciniis lateralibus patentibus cum lacinia intermedia angulum acutum facientibus bene 0.7 cm longis ex ungue late lineari 0.24 cm longo dilatatis et $^{3}/_{5}$—$^{2}/_{3}$ partibus superioribus extus in lacinulas c. 7 inaequales patentes lineares 0.14—0.38 cm longas partitis, lacinia intermedia recta lineari anguste obtusa 0.65 cm longa, 0.075 cm lata; calcar dependens, rectum, clavatum, dimidio superiore inflato, 1.65 cm longum. Gynostemium usque ad apicem processuum stigmaticorum c. 0.53 cm metiens, connectivo hippocrepidiformi, thecis longe remotis subovalibus, canalibus thecas superantibus incurvis linearibus, auriculis parvis. Processus stigmatici porrecti, canales superantes, apice recurvi, oblongi, falcati, subacuti. Ovarium pedicellatum.

Bali: Goenoeng Agoeng, southern slope, 1500—2000 m, grass-fields, common (*C. G. G. J. van Steenis n. 7790, type,* in Herb. Buitenz. and Leiden, 6 April 1936; "odour of hyacinths").

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*) XVI in Bull. Jard. Bot. Buit. 3e sér. XIV, 2 (1937), 160.

1) This paper was originally intended to be published in the Bulletin of the Government Botanic Garden, Buitenzorg, but the war prevented me from doing so and made me request the hospitality of "Blumea".

Near *H. tosariensis* J. J. S. from Java but with smaller flowers, a hardly ovate dorsal sepal, much broader petals, a relatively longer spur, a broader connective more in the way of *H. multipartita* Bl.

Description from herbarium.

Odontochilus sumatranus J. J. S., n. sp.

Caulis elongatus, inferne decumbens et radicans, c. 30 cm longus, parte foliata c. 5.5 cm longa. Folia c. 4, petiolata, oblique ovata, acuminata, acuta, basi late obtusa vel rotundata, brevissime in petiolum acuminata, costa media subtus prominente, 2.4—4.2 cm longa, 1.3—2.3 cm lata; petiolus canaliculatus, cum vagina tubulosa apice valde obliqua 1.3—1.5 cm longus. Inflorescentia folia paulum superans, pauciflora, pedunculo pubescenti, c. 3.5 cm longo, vaginulis 2 tubulosis donato, rachide pubescenti, c. 2 cm longa. Bracteae adpressae, ovatae, sensim acuminatae, acutae, dorso sparse pilosae, ciliatae, concavae, 1-nerviae, c. 0.925 cm longae, absque ciliis 0.375 cm latae. Flores c. 4, patentes, macerati 2 cm longi. Sepalum dorsale erecto-patens, concavum, ellipticum, longius triangulo-acuminatum, obtusum, dorso sparse longius pilosum, 1-nervium, 0.6 cm longum, 0.27 cm latum. Sepala lateralia basi saccum labelli amplectentia, oblique oblonga, superne angustata, acuta, basi unilateraliter sacculato-concava, dorso sparse longius pilosa, 1-nervia, 0.9 cm longa, 0.4—0.425 cm lata. Petala sepalo intermedio agglutinata, oblique anguste oblonga, acuminata, acuta, falcata vel potius subsigmoidea, manifeste inaequilatera, margine exteriore medio rotundato-dilatata, glabra, 1-nervia, 0.65 cm longa, medio 0.225 cm, infra medium 0.175 cm lata. Labellum magnum, basi breviter saccatum, sacco marginibus gynostemio adpresso, alte bilobo, lobis plica introrsa intus glandulam uncinatam gerente munitis, supra saccum unguiculatum, ungue marginibus arcte induplicatis contiguis lineari a dorso compresso utrinque laciniis c. 6 patentissimis obtusis 3 inferioribus abbreviatis 3 superioribus bene longioribus oblongis ad linearibus usque ad 0.225—0.25 cm longis donato, 0.7 cm longo, 0.175 cm ad lacinias longissimas 0.575 cm lato, lamina maxima, bene ultra bipartita, ambitu quadrangula, basi truncata, c. 1.1—1.2 cm longa, 1.1 cm lata, lobis porrectis, ovato-triangulis, marginibus leviter rotundato-curvatis, margine exteriore denticulato-erosis, obtusis, 0.9—fere 1 cm longis, 0.6 cm latis, denticulo parvo recurvo in sinu inter lobos, subtus longitudinaliter sulcatum, totum 2.15 cm longum. Gynostemium breve. Ovarium sessile, apice leviter incurvulum, glabrum, 1.5 cm longum.

Sumatra: Atjeh, Gajolanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, moss-grown forest (*C. G. G. J. van Steenis n. 10043, type,* in Herb. Leiden, 23 March 1937).

A species with manifestly falcate petals and a relatively very large blade of the lip. The laciniae of the claw of the lip are rather unequal, the lowermost being very short, the other ones much longer. The glands in the sac are uncinate like in *O. flavescens* Bl.

Description from a single dried specimen.

Coelogyne (sect. *Cristatae*) **kemiriensis** J. J. S., n. sp.

Rhizoma ......, radicibus dense villosis. Pseudobulbi novelli cum basi petiolorum vaginis tubulosis sursum accrescentibus apiculato-acuminatis usque ad 6.75 cm longis inclusi, 2-folii. Folia lanceolata, acute acuminata, basi sensim petiolato-angustata, nervis c. 5 sicco subtus prominentibus supra minus conspicuis, nervis minoribus intermixtis, 17.5 cm longa, 2.2 cm lata, parte petioliformi canaliculata, c. 4 cm longa. Inflorescentia in pseudobulbo haud plane evoluto, erecta, foliis brevior, pauciflora, pedunculo 9.5 cm longo, rachide flexuosa, 4.5—5 cm longa, internodiis 0.95—1.2 cm longis. Bracteae caducae. Flores 5—6, simultanei, majusculi. Sepalum dorsale anguste oblongum, anguste obtusum, apiculatum, 5-nervium, costa media dorso prominula, 3.8 cm longum, supra medium 1.1 cm latum. Sepala lateralia anguste oblique oblonga, subfalcata, acuta, apiculata, 5-nervia, costa media dorso carinata, 3.7 cm longa, 0.9 cm lata. Petala oblique lanceolata, acuta, 3.6 cm longa, 0.64 cm lata. Labellum 3-lobum, expansum cuneato-obovatum, 3.3 cm, usque ad apicem loborum lateralium 2.8 cm longum, 1.8 cm latum, carinis 3 humilibus tenuibus crenulato-undulatis omnibus supra basin conspicue elevatis rectisque parte elevata antice dente porrecto obliquo obtuso terminata, carina intermedia fere usque apicem producta, carinis 2 sequentibus supra medium bene elevatis undulatis crenatisque medio lobi intermedii circiter evanescentibus, supra basin utrinque costa brevi recta dente obtuso terminata addita, 5-nervium; loborum lateralium pars libera porrecta, oblique ovata, obtusa, fere 0.6 cm longa, 0.55 cm lata; lobus intermedius laterales superans, late ovatus, rotundato-obtusus, apiculatus, erosulus, undulatus, 1.2 cm longus, 1.1 cm latus. Gynostemium gracile, leviter arcuatum, sursum sensim alatum, ala apice irregulariter angulata, 2.9 cm longum, clinandrio concavo. Anthera cucullata, convexa, ambitu ovata, apice contracta truncata, basi bilobulata, 0.325 cm longa, 0.3 cm lata, connectivo basi conico-gibboso. Pollinia 4, ovali- ad obovato-oblonga. Rostellum latum, apice recurvum, convexum. Stigma semilunatum, margine inferiore elevatum. Ovarium acute 6-costatum, c. 1 cm longum; pedicellus 1.2 cm longus.

Sumatra: Atjeh, Gajolanden, G. Kemiri, eastern slope, bivouac 2 to summit, 2900—3314 m, ridge in forest and plateau (*C. G. G. J. van Steenis n. 9636, type,* in Herb. Leiden, 7 March 1937; "terrestrial; flowers white with some brown markings on the keels"). Summit of the Goh Lemboeh, 3000 m, moss-grown forest (*C. G. G. J. van Steenis n. 9054,* in Herb. Buitenz., 20 February 1937; "flowers white with a brown blotch in the throat").

In n. 9054 the 3 median nerves are not noticeably elevated and wrinkly. The difference is perhaps due to the method of treatment of the material. In this specimen the dry pseudobulbs are oblong-ovoid, somewhat flask-shaped and measure 3.5 cm in length.

Easily distinguishable from the other species of the *Cristatae*-group with caducous bracts especially by the relatively narrow, cuneate obovate lip.

Description from herbarium.

Pholidota Sigmatochilus J. J. S., comb. nov. — *Sigmatochilus kinabaluensis* Rolfe in Journ. Linn. Soc. Bot. XLII (1914), 155, pl. 3.

Planta parva, pseudobulbis approximatis, ovoideis, versus apicem attenuatis, sicco c. 1.75—2.5 cm longis, 1-foliis, initio vaginis imbricatis inferne tubulosis acuminatis acutis sicco prominenter nervosis superioribus accrescentibus usque ad 4—6 cm longis inclusis. Folium petiolatum, lanceolatum, subacutum, basi acute in petiolum angustatum, costa media sicco supra canaliculata subtus prominente, sicco rigide coriaceum, c. 5.75—6.5 cm longum, 1.15—1.25 cm latum; petiolus tenuiusculus, canaliculatus, c. 2.2 cm longus. Inflorescentia folio immaturo synantha, erecta, folio subaequilonga vel paulo longior, pauciflora, pedunculo 6.25—7.5 cm longo, rachide 1.7—2.8 cm longa, internodiis c. 0.4—0.7 cm longis. Bracteae persistentes, concavae, ovatae, sensim acuminatae vel angustatae, acutae, sicco dorso prominenter nervosae, usque ad c. 1.4 cm longae. Flores c. 5—6, haud plane apertae, 1 cm longae. Sepalum dorsale concavum, apice vix recurvulum, subovatum, obtusum, 5-nervium, fere 1.1 cm longum, 0.55 cm latum. Sepala lateralia oblique ovata, versus apicem angustata, obtusiuscula, leviter concava, 5-nervia, costa media dorso prominente, c. 1.1 cm longa, bene 0.6 cm lata. Petala late linearia, subspathulata vel leviter dilatata, obtusa, 3-nervia, c. 1 cm longa, basi 0.15 cm, superne c. 0.25 cm lata. Labellum porrectum, gynostemium conspicue superans, cum gynostemio angulum acutum cum ovario angulum obtusum faciens, sigmoideum, concavum, costis 2 brevibus longitudinalibus fasciam incrassatam satis latam canaliculatam in basi epichilii abrupte terminantem breviter in hypochilium decurrentem formantibus, 5-nervium, inexplanatum 0.8 cm longum; hypochilium oblongo-saccatum, subtus rotundato-angulatum, inexpansum extus 0.44 cm longum, superne c. 0.2 cm latum; epichilium acutangule recurvum, apice recurvum, marginibus basi erectis rotundatisque, expansum ovato-quinquangulare, apice breviter triangulo-producto subtrilobulatum, obtusum, 0.58 cm longum, basi 0.375 cm, infra apicem 0.3 cm latum. Gynostemium breve, clavatum, clinandrio oblique truncato, marginibus utrinque 4-crenato, apice breviter triangulo obtuso. Anthera cucullata, ambitu rotundato-quadrangula, apice rotundato-excisa, basi 0.12 cm lata, connectivo valde gibboso. Rostellum latum, rotundato-excisum, 2-dentatum. Stigma semilunare. Ovarium 6-sulcatum, 0.5 cm longum; pedicellus 0.64 cm longus.

British North Borneo: Kinabalu, below Paka Paka, 3000 m, terrestrial in open scrub on serpentine (*L. S. Gibbs n. 4260,* Febr. 1910; "flowers white"). Above Paka Paka, 3800 m, on rocks (*J.* and *M. S. Clemens n. 27153,* 14 Nov. 1931). Upper Kinabalu, 2000—4500 m (*J.* and *M. S. Clemens n. 27866,* 8 Jan. 1932). Main spur between Kamborangah and Paka Paka, terrestrial on rocks, under scattered dwarfed *Leptospermum,* 3200 m (*C. E. Carr n. 3524,* June 1933; "young leaves reddish, inflorescence and bracts red, pedicel and ovary red or olive suffused red, sepals and petals creamy white, lip white, column bright yellow-green").

When examining Clemens n. 27866 (which number was enumerated by C. E. Carr in The Gard. Bull. Str. Settl. VIII, 1935, 228, as *Dendrochilum grandiflorum* J. J. S.) of the Leiden set, it proved to be *Sigmatochilus kinabaluensis* Rolfe. However, in my opinion the plant belongs to the genus *Pholidota.* Transferring the species to that genus I could not use the name *kinabaluensis* on account of the fact that Oakes Ames described already in 1920 a *Ph. kinabaluensis.*

In the structure of the lip it somewhat resembles *Ph. camelostalix* Rchb.f. and *Ph. Clemensii* Ames, but I do not know a near ally.

Description from *Clemens n. 27866.*

Pholidota (sect. *Crinonia*) **rupestris** J. J. S., n. sp.

Rhizoma breve, vaginis acuminatis acutis usque ad 2—2.75 cm (sub pseudobulbis) longis. Pseudobulbi approximati, sicco oblongi vel plus minusve ovoidei vel plus minusve angulati, rugulosi, 1.5—2.5 cm longi, 2-folii. Folia lanceolata, apice deficiente, basi subpetiolato-angustata, nervis c. 7 majoribus pluribusque minoribus supra subtusque prominulis, 4—5.75 cm longa, 0.7—0.65 cm lata, parte petioliformi canaliculata. Inflorescentia e pseudobulbo novello submaturo, laxe pauci-pluriflora, pedunculo filiformi, 1.3—3.5 cm longo, rachide flexuosa, angulata, 2.75—5.5 cm longa, internodiis 0.35—0.45 cm longis. Bracteae caducae, alternatim bifariae, nonnullae inferiores subpersistentes, adpressae, concavae, oblongo-quadrangulae, brevissime abrupte acuminatae, stramineae, ad 0.75 cm longae, 0.35 cm latae, circiter 5-nerviae. Flores ad c. 12, parvuli, carnosuli. Sepalum dorsale oblongo-ovatum, obtusum vel obtusiusculum, concavum, 3-nervium, costa media dorso convexo-prominente, 0.55—0.57 cm longum, 0.28 cm latum. Sepala lateralia oblique oblongo-ovata, obtusa, apiculata, oblique cymbiformi-concava, 3-nervia, costa media dorso crasse carinata, 0.6 cm longa, 0.28—0.3 cm lata. Petala suboblique oblongo-ovata, acutiuscula vel obtusiuscula, dorso medio incrassata cum sulco longitudinali, marginibus tenuiora, 3-nervia, 0.54—0.55 cm longa, 0.225—0.24 cm lata. Labellum concavum, basi distincte rotundato-saccatum, sacci pariete postico intus convexo-incrassato, marginibus erectis inconspicue rotundato-dilatatis, epichilio oblongo, obtuso, supra saccum leviter constricto, superne infra apicem marginibus dilatatis incurvisque, subirregulariter marginatis, costis 2 longitudinalibus in medio labelli, superne medio incrassatione convexa longitudinali ante costas, subtus sulco tenui longitudinali, totum 0.5—fere 0.6 cm longum, ad saccum 0.14 cm, supra saccum 0.1 cm, superne 0.15 cm latum. Gynostemium breve, submalleiforme, usque ad apicem rostelli c. 0.2 cm longum, clinandrio apice postice producto, aequilateraliter trapeziformi, retuso. Anthera cucullata, orbicularis, apice truncata, connectivo crasse gibboso, 0.1 cm lata. Rostellum cum stigmate cupulam obliquam prominentem faciens. Ovarium obconicum, 6-sulcatum, 0.15 cm longum; pedicellus brevis, tenuior, 0.1 cm longus.

Sumatra: Atjeh, Gajolanden, G. Leuser, central peak, bivouac 6, 3300—3500 m, stony places and rocks on summit (*C. G. G. J. van Steenis nrs. 8578 and 8579*, both type, in Herb. Leiden, 2 February 1937).

This is to be reckoned to a small group of species to which *Ph. carnea* Lndl. and *Ph. globosa* Lndl. belong.

One of the specimens, n. 8578, shows a monstrosity in the vegetative parts, which will be described in one of the next series of Dr. S. J. van Ooststroom.

The description was drawn up from both numbers, each of which consists of a small portion of a plant.

Dendrochilum (sect. *Monochlamys*) **kabense** J. J. S., n. sp.

Rhizoma elongatum, dependens, valde ramosum, teres, sicco rugosum, praesertim basi radicans, c. 60 cm longum, internodiis 0.5—1.8 cm longis, initio vaginis tubulosis dense sicco prominenter nervosis fuscis novellis leviter obscurius punctatis opacis sursum accrescentibus usque ad 3.5—3.75 cm longis tectum. Pseudobulbi dissiti, rhizoma continui, teretes, obtusi, sicco longitudinaliter rugosi, 1.5—3 cm longi, sicco 0.25 cm, interdum 0.4—0.6 cm crassi, unifolii. Folium ovato-oblongum ad -lanceolatum, plerumque contracto-acuminatum, breviter acutum, plerumque apiculatum, basi breviter acute in petiolum acuminatum, nervis 7—9 majoribus pluribus minoribus sicco supra subtusque prominentibus, reticulato-venosum, papyraceum, c. 5.5—12.5 cm longum, 1.2—5 cm latum; petiolus canaliculatus, 0.4—1 cm longus. Inflorescentia in pseudobulbis maturis, folium longe superans, laxe multiflora, pedunculo filiformi, 3.25—5 cm longo, rachide quadrangula, haud vel vix flexuosa, 12—14 cm longa, internodiis 0.2—0.25 cm longis. Bracteae convolutae, abbreviato-ovatae, apiculatae, c. 0.25 cm longae, 0.28 cm latae. Flores alternato-bifarii. Sepalum dorsale lanceolatum, acutatum, convexum cum canalicula longitudinali, 3-nervium, c. 0.45 cm longum, 0.15 cm latum. Sepala lateralia divergentia, apice subrecurvula, canaliculata, oblique ovato-lanceolata, apicem versus angustata, acutiuscula, 3-nervia, c. 0.46 cm longa, bene 0.15 cm lata. Petala ovata, acutiuscula, celluloso-erosula, 3-nervia, c. 0.36 cm longa, 0.18 cm lata. Labellum adscendens, 3-lobum, 3-nervium, expansum 0.33 cm longum; lobi laterales breves, recurvuli, convexi, angulo antico obtusi vel acuti, irregulariter plus minusve 2-crenulati, papillosi, hypochilium concavum extus longitudinaliter 3-costulatum intus lamellis 2 longitudinalibus conspicuis antice magis elevatis truncatisque supra basin labelli rectangule incurvis margine postico contiguis cavitatem formantibus donatum expansum trapeziforme fere 0.1 cm longum 0.17 cm latum facientes; lobus intermedius recurvus, canaliculatus, ovatus, apicem versus angustatus, vix acuminatus, acutus, crassiusculus, dense papillosus, expansus 0.23 cm longus, 0.18 cm latus. Gynostemium brevissimum, dorso sigmoideum convexumque cum costa longitudinali, parte inferiore contractum, fere 0.1 cm longum, ala apicali concava, lata obtuse 3-lobulata, alis lateralibus paululum infra medium ortis ala apicali vix brevioribus linearibus obtusis concavis. Anthera sub ala apicali abscondita, cordato-triangula, apice recurvulo truncata, basi bilobulata, connectivo costato-incrassato. Rostellum conspicuum, porrectum, supra concavum, subtus convexum, apice incurvum. Stigma conspicuum, margine valde elevatum, cum rostello oblique cupuliforme. Ovarium 6-sulcatum, 0.1 cm longum; pedicellus ovario paulo tenuior, bene 0.1 cm longus.

Sumatra: Bengkoeloe, Kaba, 1600 m, old forest, rather common (*C. N. A. de Voogd n. 1470, type*, in Herb. Buitenz. and Leiden, 10 November 1931; "flowers greenish white").

Nearly related to *D. decipiens* J. J. S. but differing by the smaller differently coloured flowers, more conspicuously erose petals, strongly recurved midlobe of the lip, relatively shorter lateral wings of the column, a broader stigma and rostellum. The sheaths of the rhizome are slightly punctate light brown when young.

Description from herbarium.

Dendrochilum (sect. *Platyclinis*) **atjehense** J. J. S., n. sp.

Rhizoma breve, radicibus crassiusculis, vaginis sursum accrescentibus pseudobulbum novellum includentibus acutis sicco prominenter nervosis brunnee punctatis deinde fatiscentibus et interdum fibras relinquentibus usque ad 3.25—5.5 cm longis tectum. Pseudobulbi approximati, sicco tenues, subteretes, rugulosi, 2—4.25 cm longi. Folium lineare, brevissime acutum, apiculatum, saepe in 1.75—3.75 cm infra apicem plus minusve contractum, basi sensim subpetiolato-angustatum, nervis 5 subtus prominentibus, rigidulum, totum 9.5—22 cm longum, 0.9—0.6 cm latum, parte petioliformi canaliculata 0.7—2 cm longa. Inflorescentia in pseudobulbo novello nondum plane evoluto, erecta, satis dense multiflora, disticha, plerumque folium plus minusve excedens, pedunculo filiformi, 8.5—17 cm longo, rachide inconspicue flexuosa, compressa in lateribus angustis sulcata, 5—8 cm longa, internodiis c. 0.25 cm longis. Bracteae alternatim bifariae, patentes, ovarium amplectentes, cymbiformes, late triangulae, acutae, membranaceo-marginatae, 7-nerviae, 0.36 cm longae, 0.38 cm latae. Flores erecto-patentes, rachidi subadpressi. Sepalum dorsale oblongo-triangulum, subacuminatum, acutum, 3-nervium, 0.47 cm longum, bene 0.15 cm latum. Sepala lateralia oblique oblongo-ovata, acuta, apiculata, dorso carinata, 3-nervia, 0.5 cm longa, 0.18 cm lata. Petala oblongo-ovalia vel -elliptica, acuminata, acutiuscula, concava, 3-nervia, fere 0.4 cm longa, 0.17 cm lata. Labellum parvum, porrectum, 3-lobum, basi concavum, 3-nervium, nervis in flore macerato brunneis, lamellis 2 satis altis lobos laterales aequantibus antice abrupte rotundatis basi U-formiter conjunctis supra basin in nervis exterioribus, expansum bene 0.8 cm longum, ad lobos laterales 0.17 cm latum; lobi laterales erecti, concavi, apice libero porrecti, rotundati, integerrimi; lobus intermedius multo longior, anguste triangulus, apicem versus angustatus, acutus, 0.225 cm longus, 0.075—0.08 cm latus. Gynostemium brevissimum, dorso convexum, 0.125 cm longum, alis lateralibus apicalem fere aequantibus, brevissimis, late rotundatis, ala apicali suggrundiformi, irregulariter 3-lobulata vel 3-dentata, subtus concava. Anthera cucullata, connectivo alte gibboso. Stigma cupuliforme. Ovarium 6-sulcatum, 0.125—0.15 cm longum.

Sumatra: Atjeh, Gajolanden, G. Leuser, bivouac 4 to 5, 2700—2800 m, watershed (*C. G. G. J. van Steenis n. 8540, type,* in Herb. Buitenz. and Leiden, 31 January 1937).

A species well characterized by the narrowly triangular midlobe of the lip, and the small column. I do not know a species with which it can be confused.

Description from herbarium.

Dendrochilum (sect. *Platyclinis*) **fimbrilobum** J. J. S., n. sp.

Rhizoma breve, vaginis imbricatis obtusiusculis vel obtusis apiculatis dense prominenter nervosis (sicco) praesertim costa media obscure punctatis superioribus pseudobulbum et basin folii arcte includentibus usque ad 5—6 cm longis. Pseudobulbi approximati, recti vel saepe curvati, sicco teretes, anguste ovoidei vel oblongo-ovoidei, rugulosi, 2.2—1.5 cm longi, 0.3—0.43 cm diam. Folium anguste lineare, apice plus minusve conduplicatum, obtusum vel obtusiusculum, basi sensim petiolato-angustatum, nervis validioribus subtus prominentibus tenuioribus intermixtis, rigidule coriaceum, 21—25 cm longum, 0.3 cm latum, parte petioliformi tenui, canaliculata. Inflorescentia e pseudobulbo novello fere evoluto, erecta, folium quodammodo superans, multiflora, pedunculo tenui, subtereti, laxe puncticulato, 16—17.5 cm longo, rachide angulata, anguste alata, 10—13 cm longa. Bracteae alternatim bifariae, florescentia patentissimae, ovato-triangulae, acutae, marginibus involutis, costa media dorso prominente, 0.35 cm longae. Flores mediocres. Sepalum dorsale anguste lanceolatum, versus apicem angustatum, acutum, apiculatum, concavum, 3-nervium, 0.6 cm longum, fere 0.15 cm latum. Sepala lateralia oblique lanceolata, versus apicem sensim angustata, canaliculato-acuta, 3-nervia, costa media dorso incrassata, 0.63 cm longa, 0.15 cm lata, acuminata, acuta, basi contracta, basi excepta erosula, 3-nervia, costa media incrassata, 0.5 cm longa, 0.1 cm lata.

Labellum 3-lobum, 3-nervium, nervis exterioribus incrassatis, expansum ambitu ellipticum, 0.36 cm, usque ad apicem loborum lateralium 0.16 cm longum, ad lobos laterales 0.15 cm latum; lobi laterales satis lati, antice breviter producti, margine irregulariter fimbriati; lobus intermedius rhombeus vel potius quinquangulari-rhombeus, satis acutus, parte inferiore excepta serrulato-erosulus, fere 0.2 cm longus, infra medium 0.16 cm latus. Gynostemium breve, fere 0.2 cm longum, alis lateralibus cum ala apicali angulum acutum facientibus, infra medium insertis, ala apicali brevioribus, lineari-subulatis, acutis, falcatulis, ala apicali porrecta, lata, bifida, lobulis triangulis. Anthera cucullata, apice obtusangula, connectivo gibboso. Ovarium pedicellatum 0.2 cm longum.

Sumatra: Atjeh, Gajolanden, from the summit of the Goh Lemboeh to bivouac Halfweg, 2400 m, ridge in forest (*C. G. G. J. van Steenis n. 9159, type,* in Herb. Buitenz. and Leiden, 23 February 1937).

The lip of this species much resembles that of some of the forms of *D. linearifolium* Hook. f. as depicted in his Icones XIX, t. 1859, but in other respects it is quite different.

Description from herbarium.

Dendrochilum (sect. *Platyclinis*) **rhombeum** J. J. S., n. sp.

Planta parva. Rhizoma breve, repens, radicans, vaginis sursum accrescentibus pseudobulbum novellum includentibus acutis vel apiculatis obscurius punctatis sicco dense prominenter nervosis usque ad 2—2.5 cm longis tectum. Pseudobulbi approximati, oblongo-ovales vel leviter ovoidei, apice attenuati, rugulosi, 1.4—2 cm longi, 1-folii. Folium distincte petiolatum, lanceolatum, apice angustatum, obtusum vel breviter acutum, basi acutum, nervis c. 5 majoribus pluribusque tenuibus subtus et etiam supra prominulis, papyraceo-coriaceum, 5.75—7 cm longum, 0.8—1.3 cm latum; petiolus tenuis, canaliculatus, 1.5—2 cm longus. Inflorescentia e pseudobulbo novello nondum plane evoluto, folium superans, laxe pluriflora, pedunculo tenuiter filiformi, nigrescente hirtello, 5.5 cm longo, rachide curvata, angulata angustissime alata, hirtella, 5.5—6.8 cm longa, internodiis 0.35—0.4 cm longis. Bracteae persistentes, nonnullis inferioribus adpressis sterilibus, ovatae, acutae, c. 0.325 cm longae, fere 0.25 cm latae. Flores c. 14—16, macerati bene 1 cm diam. Sepalum dorsale ovato-lanceolatum, obtusum, minute apiculatum, concavum, 3-nervium, 0.6 cm longum, 0.18 cm latum. Sepala lateralia suboblique ovato-lanceolata, oblique acutiuscula, 3-nervia, costa media dorso carinata, bene 0.6 cm longa, 0.2 cm lata. Petala triangulo-lanceolata, versus apicem angustata, acuta vel breviter apiculata, erosula, 3-nervia, 0.56 cm longa, 0.175 cm lata. Labellum 3-lobum, basi breviter transverse rectangule unguiculatum, nervis 3 incrassatis usque prope apicem, nervis exterioribus in lobo medio exterius ramosis, expansum 0.57 cm, usque ad apicem loborum lateralium 0.175 cm longum, ad lobos laterales bene 0.2 cm latum, ungue 0.05 cm longo, 0.1 cm lato; lobi laterales parvi, aliformes, trapezioidei, interdum apiculati, margine exteriore erosuli; lobus intermedius multo major, porrectus, rhombeus, acutus, utroque latere rotundatus, 0.4 cm longus, medio fere 0.35 cm, basi fere 0.1 cm latus. Gynostemium satis gracile, leviter arcuatum, 0.3 cm longum, alis lateralibus e basi ortis, porrectis, elongatis, gynostemium aequantibus, linearibus, ala apicali conspicua, porrecta, quadrata, apice truncato circiter 5-dentata.

Anthera cucullata, ovato-triangula, leviter acuminata, acutiuscula, lobulis 2 parvis ad basin, fere 0.05 cm lata. Rostellum porrectum, triangulum. Ovarium pedicellatum 0.1 cm longum.

Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, forest slope above Penosan, 1500 m (*C. G. G. J. van Steenis n. 8320, type,* in Herb. Leiden, 27 January 1937).

The variation in the genus *Dendrochilum* is endless but the species are in general well characterized. The new species can be recognized easily by the shape of the lip. In the column it closely resembles *D. longipes* J. J. S. and a few others.

The indumentum of the inflorescence recalls the hairlike covering of some Orchids in the mountains of New Guinea, which is caused by *Clasterosporium Glomerae* v. Overeem.

Description from herbarium.

Dendrochilum (sect. *Platyclinis*) **quinquangulare** J. J. S., n. sp.

Rhizoma repens, radicibus crassiusculis, vaginis versus pseudobulbos accrescentibus acutis dorso carinatis dense dorso prominenter nervosis initio leviter obscurius punctatis fatiscentibus temporarie fibras relinquentibus usque ad 3.5—4.25 cm longis. Pseudobulbi approximati, cum rhizomate angulum acutum facientes, sicco anguste ovoidei, valde rugulosi, straminei, 1.2—2.5 cm longi. Folium petiolatum, lanceolato-lineare, obtusum vel conduplicato-acutum, apiculatum, basi acutum, nervis majoribus 5—7 dorso prominentibus (praesertim costa media), numerosis tenuibus intermixtis, rigidulum, tenuiter coriaceum, totum 6.75—8.25 cm longum, 0.6—0.8 cm latum; petiolus satis distinctus, canaliculatus, 1—1.2 cm longus. Inflorescentia e pseudobulbo novello non plane evoluto, erecta, folium longe superans, laxe satis multiflora, pedunculo filiformi, 5—11 cm longo, rachide superne flexuosa, lateraliter compressa, anguste 4-alata, 3—7.5 cm longa, internodiis 0.35—0.9 cm longis. Bracteae patentissimae, cymbiformes, lanceolatae, apicem versus angustatae, acutae, apiculatae, 3-nerviae, 0.6 cm longae, 0.15 cm latae. Flores c. 9—18, in specimine supra-axillares. Sepalum dorsale oblongo-quinquangulare, circiter a medio vel paululum infra medium versus apicem angustatum, acutum, apiculatum, concavum, 3-nervium, 0.64 cm longum, 0.26 cm latum. Sepala lateralia oblique ovato-triangula, subfalcatula, leviter acuminata, acuta, 3-nervia, 0.64 cm longa, 0.3 cm lata. Petala lata, oblique ovato-rhombea, acuta, 3-nervia, 0.55 cm longa, 0.34 cm lata. Labellum latissimum, subsimplex, inconspicue 3-lobum, ambitu late quinquangulare, circiter $^1/_3$ superiore (lobo intermedio) leviter contractum, apice late obtusangulum, basi latum, truncatum, brevissime unguiculato-contractum, hypochilio (lobis lateralibus) basi excepta minute crenulato-erosulo, 3-nervium, nervis exterioribus praesertim in medio labelli carinatis, omnibus basi incrassatis callum transversum formantibus, totum 0.45 cm longum, basi 0.475 cm latum, ungue 0.05 cm longo, lobo intermedio 0.13 cm longo, 0.4 cm lato. Gynostemium gracile, leviter curvatum, clavatum, subtus concavum, 0.375 cm longum, alis lateralibus circiter e medio ortis, gynostemio multo brevioribus, leviter falcatulis, triangulis, acutis, c. 0.05 cm longis, clinandrio concavo, ala apicali brevissima, apice breviter 2- vel plus minusve 4-lobulata, pede subdistincto, fere 0.1 cm longo. Anthera cucullata, obtusa, basi bilobulata, connectivo gibboso. Rostellum porrectum, triangulum. Ovarium 6-sulcatum, cum pedicello 0.3—0.4 cm longum.

Sumatra: Atjeh, Gajolanden, G. Leuser, 2700—2800 m, bivouac 4 to 5, watershed, brook-valley (*C. G. G. J. van Steenis n. 8492, type,* in Herb. Buitenz. and Leiden, 31 January 1937). G. Leuser, central top, bivouac 6, 3300—3500 m, rocks of the summit (*C. G. G. J. van Steenis n. 8580,* in Herb. Buitenz., 2 February 1937). Summit Goh Lemboeh, 3000 m, blang, on the rocks (*C. G. G. J. van Steenis n. 9080,* in Herb. Buitenz., 21—22 February 1937).

A well-marked species with a very broad, nearly simple lip.

In the type specimens the flowers are distinctly supra-axillary, which is not so obvious in the other numbers. I suppose that n. 8492 was collected in a more shadowy spot.

Description from herbarium.

Tainia (sect. *Ascotainia*) **Steenisii** J. J. S., n. sp.

Rhizoma teres, vaginis verticillos fibrarum relinquentibus, radicibus crassiusculis valde villosis. Pseudobulbi sicco conici, 2.25 cm longi, 0.6 cm diam., 1-folii, vagina acuta c. 10 cm longa ad basin. Folium longe petiolatum, lanceolatum, apice deficiente, basi acutum, nervis subtus prominentibus, papyraceum, parte adest 13 cm longa; petiolus apice canaliculatus, c. 24 cm longus. Inflorescentia laxe pauciflora, pedunculo 39 cm longo, vaginulis c. 7 tubulosis acutis superne laxioribus ad c. 2.7 cm longis donato, rachide c. 17 cm longa. Bracteae lanceolatae, versus apicem angustatae, acutae, 0.8 cm longae, superiores minores. Flores c. 6. Sepalum dorsale anguste lanceolatum, apice brevissime recurvum canaliculatumque, acutum, 5(—7)-nervium, 1.65 cm longum, 0.34 cm latum. Sepala lateralia manifeste ad pedem gynostemii decurrentia, anguste oblique lanceolata, falcatula, superne revoluta, apice brevissime recurva canaliculataque, apiculato-acuta, 7-nervia, 1.75 cm longa, fere 0.4 cm lata. Petala oblique lineari-lanceolata, falcatula vel subsigmoidea, acute acuminata, 3(—5)-nervia, 1.75 cm longa, 0.28 cm lata. Labellum apici pedis gynostemii insertum, gynostemio parallelum et longius, concavum, 3-lobum, calcaratum, costis 5 longitudinalibus humilibus superne bene elevatis undulatis et irregulariter marginatis apicem labelli non attingentibus, expansum ambitu oblongo-obovatum, basi angustatum, absque calcari 1.45 cm, usque apicem loborum lateralium 1.2 cm longum, ad lobos laterales 0.76 cm latum; lobi laterales parvi, trianguli, obtusi; lobus intermedius multo major, valde recurvus, undulatus, late triangulus, acutus, 0.4 cm longus, 0.55 cm latus; calcar reversum, cum ovario angulum acutum faciens, breve, oblongum, maceratum lateraliter compressum cum sulco longitudinali, obtusum, 0.225. cm longum. Gynostemium fere rectum, dorso convexum, subtus concavum, bene 1 cm longum, clinandrio excavato, margine dentato, filamento lato, transverso, aequilateraliter trapeziformi, pede recurvo, fere 0.2 cm longo. Anthera cucullata, 4-angula vel potius ambitu quinquangularis, basi bilobula, apice in rostrum parvum recurvum supra convexum subtus concavum retusum producta, 0.2 cm longa, thecis suborbicularibus convexis, connectivo medio gibberis 2 subglobosis postice in dentem productis donato. Pollinia 8, lateraliter compressa, breviter obovata ad semiobovata, c. 0.06—0.1 cm longa. Ovarium pedicellatum tenue, 6-sulcatum, 1.5 cm longum.

Sumatra: Atjeh, Gajolanden, G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1400 m, forest ridge (*C. G. G. J. van Steenis n. 8960, type,* in Herb. Leiden, 18 February 1937).

Among the species of this affinity with a three-lobed lip only *T. viridi-*

fusca Bth. has been described, so far I know, with 5 ridges on the lip. From this species *T. Steenisii* differs in the smaller dimensions, smaller side-lobes, and a triangular, not suborbicular midlobe of the lip.

The material consists in 2 specimens, which, I think, belong to the same species. The one described possesses a distinctly conic pseudobulb with a much damaged leaf. It is not quite clear from where the inflorescence arises. The other specimen I take to be a young one; it is much weaker. The dry pseudobulbs are terete and equally thick as the rhizome. They are placed about 4 cm apart. The leaf is lanceolate, long acuminate, about 13 cm long and 1.75 cm broad, with a petiole of 15 cm. The inflorescence appears to arise 0.8—1 cm above the base of the pseudobulb in the way of *T. elongata* J. J. S. There is only one (defective) flower in this specimen.

Description only from the strongest specimen.

Ceratostylis (sect. *Pleuranthemum*) **Steenisii** J. J. S., n. sp.

Planta conspicua, rhizomate elongato, dependente, ramoso, apicibus incurvo, vaginis adpressis imbricatis acutis vel acuminatis superioribus accrescentibus usque ad c. 4 cm longis, deinde reticulatis, radicibus tenuibus pubescentibus. Caules (vel pseudobulbi) parvi, c. 6—8 cm dissiti, cum rhizomate angulum acutum facientes, 0.6—0.7 cm longi, 1-folii. Folium articulatum, lanceolatum, acutum vel apice conduplicato-acuminatum, basi conduplicata contractum, costa media supra sulcata, sicco firmiter rigide coriaceum vel crasse coriaceum, 9—15 cm longum, 1.3—1.7 cm latum. Inflorescentia fascicularis, pedunculis paucis, 1-floris, pubescentibus, 1.3—2.2 cm longis. Bractea erecta, valde concava, ovato-triangula, conduplicato-apiculata, acuta, basi lata, glabra, 3-nervia, 0.85 cm longa. Flos majusculus. Sepalum dorsale oblongo-ovale, marginibus fere parallelis, apice obtusangulum fere rectangulum, leviter concavum, dorso ad basin parce pubescens, 5-nervium, carnosulum, 0.825 cm longum, 0.44 cm latum. Sepala lateralia lacinia brevi lata valde concava ad pedem gynostemii decurrentia, mentum subglobosum ovario adpressum 0.45 cm longum formantia, praesertim superne carnoscula, dorso praesertim versus basin pubescentia, 5-nervia, 1.2 cm longa, parte antica oblique triangula, subfalcatula, obtusa, concava, 0.8 cm longa, 0.56 cm lata. Petala lanceolato-oblonga, obtusa, apice carnosulo leviter contracta, 3-nervia, bene 0.7 cm longa, 0.25 cm lata. Labellum late spathulatum, sigmoideum, expansum 1 cm longum, ungue oblongo, 0.3 cm longo, lobulo parvo in utraque parte insertionis; lamina magna, late ovata, subtriloba, carinis 2 longitudinalibus inter lobos laterales, 0.675 cm longa, 0.6 cm lata; lobi laterales erecti, concavi, tenues, superne parce papillato-ciliati; lobus intermedius sinibus inconspicuis a lobis lateralibus sejunctus, abbreviato-ovato-triangulus, obtuso-rotundatus, carnosus, 0.24 cm longus, bene 0.4 cm latus. Gynostemium bipartitum, fere 0.3 cm longum, brachiis oblongo-quadrangulis, subtruncatis, ut videtur subretusis. Anthera cucullata, basi lata quadrilobulata, connectivo gibboso, 0.2 cm lata. Pollinia compressa, pyriformia. Pes gynostemii linearis, apice incurvo et a sepalis lateralibus libero, c. 0.3 cm longus. Ovarium pedicellatum arachnoideo-pubescens, 0.9 cm longum.

Sumatra: Atjeh, Gajolanden, G. Kemiri, east side, from bivouac Aloer to bivouac 1, 2800—3000 m, moss grown forest on the ridge (*C. G. G. J. van Steenis n. 9742, type,* in Herb. Buitenz. and Leiden, 11 March 1937; "flowers white").

Allied to *C. robusta* Hook. f., *C. Jacobsonii* J. J. S., *C. baliensis* J. J. S. etc., but with a very broad lip especially the midlobe. The length of the stems is unknown only fragments being collected.

Description from herbarium.

var. **latipetala** J. J. S., n. var.

Differt a typo petalis oblongo-subquinquangularibus, obtusiuscule vel acutiuscule acuminatis, medio apiceque incrassatis, basi semicordatis, 0.7 cm longis, 0.3 cm latis.

Sumatra: Atjeh, Gajolanden, summit Goh Lemboeh, 3000 m (*C. G. G. J. van Steenis n. 9077, type* in Herb. Leiden, 20 February 1937; "flowers white").

Calanthe (sect. *Styloglossum*) **atjehensis** J. J. S., n. sp.

Folia lanceolata, sensim longe angustissime acuminata, basi sensim longe in petiolum angustata, glabra, nervis majoribus 5 subtus prominentibus, tota 55—60 cm longa, sicco 3.3—5.1 cm lata, petiolo c. 17 cm longo. Inflorescentia foliis brevior, apice dense multiflora, glabra, pedunculo c. 29 cm longo, vaginulis c. 5 donato, 2 superioribus caducis, rachide 5 cm longa. Bracteae caducae. Flores quaquaversi. Sepalum dorsale concavum, ima apice recurvulo, ellipticum, brevissime canaliculato-apiculato-acuminatum, acutiusculum, 3-nervium, nervis exterioribus ramosis, 1.1 cm longum, 0.56 cm latum. Sepala lateralia oblique oblonga, breviter apiculato-acuminata, 1.2 cm longa, 0.425 cm lata. Petala elliptica, obtusa apiculata vel acuta vix apiculata, basi cuneato-unguiculato-contracta, 3-nervia, 1.1 cm longa, 0.45 cm lata. Labellum calcaratum, cum calcari 1.5 cm longum, longitudine c. 0.5 cm gynostemio adnatum, 3-lobum, lamina tota 0.9 cm longa, ad lobos laterales fere 0.4 cm lata; lobi laterales trianguli fere quadranguli, obtusi, margine antico recti, cum lobo intermedio angulos subrectos facientes; lobus intermedius porrectus, unguiculatus, totus fere 0.3 cm longus, ungue quadrato, fere 0.1 cm longo et lato, lamina ovata, breviter acuminata, fere 0.2 cm longa, 0.175 cm lata; calcar cum ovario angulum acutum cum labelli ungue angulum obtusum faciens, clavatum, subrectum, apice leviter recurvulum, obtusum, fere 1 cm longum. Gynostemium 0.44 cm longum, apice utrinque lobulum oblique quadrangulum versus apicem angustatum apice in denticulos 2 divergentes exeuns gerens. Anthera cucullata, apice lobulo triangulo obtuso donata. Pollinia 8, clavata. Ovarium 0.6 cm longum; pedicellus paulo tenuior, 1.1 cm longus.

Sumatra: Atjeh, Gajolanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, narrow ridge in moss-forest (*C. G. G. J. van Steenis n. 10057, type*, in Herb. Leiden, 23 March 1937; "flowers orange, a very fine plant").

One of the many *Styloglossum*-species, which is characterized by the shape of the lip, especially of the midlobe. The material was not good enough to get an idea of the callosities of the lip.

Description from a single dried specimen.

Dendrobium (sect. *Calcarifera*) **Rappardii** J. J. S., n. sp.

Caules (partes adsunt) 72—88 cm longi, internodiis 3.7—4.7 cm longis. Folia decidua, patentia, lanceolata, acuminata, acuta, basi contracta, nervis 5 majoribus sicco subtus tenuiter prominentibus, sicco rigide papyracea, ad c. 16 cm longa, 3.7 cm lata, superiora decrescentia; vaginae tubulosae, apice truncatae, sicco prominenter nervosae, internodia subaequantes. Inflorescentiae e nodis caulium defoliatorum, c. 6—9-florae, pedunculo 5 cm longo, vaginulis c. 3 donato, rachide 3—5 cm longa. Bracteae triangulae, acutae, concavae, ad c. 0.6 cm longae. Flores conspicui, macerati c. 5.75 cm longi. Sepalum dorsale lanceolatum, obtusum, c. 2.7 cm longum, non plane expansum 0.66 cm latum. Sepala lateralia cum pede gynostemii mentum conspicuum cum ovario angulum rectum faciens dorso sigmoideum apice attenuatum calcariforme obtusum totum 3.3 cm longum formantia, apice attenuato c. 0.7 cm longo, margine antico c. 1.2 cm connata, lacinia decurrente apicem menti versus angustata, parte antica oblongo-triangula marginibus curvatis, versus apicem angustata, anguste obtusa (vel acutiuscula), 7-nervia, 2.2 cm longa, basi 3.6 cm metientia, ab apice usque ad apicem menti 3.6 cm longa, parte antica bene 1.1 cm lata, lacinia decurrente curvata, fere 1 cm lata. Petala oblique cuneato-obovata, retusa, dimidio superiore apice retuso excepto eroso-denticulata, 3-nervia, nervis exterioribus ramosis, c. 2.7 cm longa, 1.6 cm lata. Labellum erectum, in c. 2.2 cm supra basin recurvum, gynostemium longe superans, subsimplex, spathulatum, angustum, expansum 4.5 cm longum, ungue lineari, 1.6 cm longo, circiter in medio lamellis 2 longitudinalibus parallelis basi dilatatis patentissimis supra basin connatis calcar decurvum a dorso compressum anguste triangulum acutum pedi gynostemii adpressum donato, lamina oblonga, apice ut videtur breviter truncato-triloba, basi acuta in unguem angustata, basi excepta eroso-denticulata, nonnullis (5?) nervis approximatis incrassatis donata (macerata), 2.7 cm longa, 1.1 cm lata. Gynostemium breve, 0.4 cm longum, auriculis triangulis obtusis apiculatis. Anthera cucullata, apice truncata papillosaque. Pes gynostemii conspicuus, cum ovario angulum rectum faciens, sigmoideus, linearis, 3.4 cm longus. Ovarium obconicum, 6-sulcatum, cum pedicello 2.7 cm longum (inexplanatum), sigmoideum.

Sumatra: 'Bengkoeloe, Aer Seblat Lebong, 650 m, primeval forest (*F. W. Rappard n. 172, type*, in Herb. Leiden, 8 September 1937; "flowers white, somewhat suffused with violet, a magnificent Orchid, stem up to 1.5 m").

The species is perhaps best compared with *D. O'Brienianum* Krzl. from the Philippines, a striped form of which seems also to occur in Celebes. The shape of the mentum and lip are very similar in both species, although they differ in every part. Also *D. corallorhizon* J. J. S. has a similar narrow lip.

Description from a single dried specimen, the flowers of which apparently were somewhat withered when collected.

Bulbophyllum (sect. *Aphanobulbon*) **gajoense** J. J. S., n. sp.

Rhizoma elongatum, repens, ad nodos radicans, initio vaginis tubulosis sicco flavo-brunneis novellis vix obscurius maculatis tectum, vagina summa pseudobulbum petiolumque includente ad c. 3 cm longa, radicibus sicco verruculosis. Pseudobulbi minuti, c. 9—10 cm dissiti. Folium ovato-lanceolatum, versus apicem sensim angustatum, satis anguste obtusum, basi abrupte in petiolum contractum, costa media sicco subtus prominente, nervis sicco supra prominulis c. 5 utrinque, sicco supra verruculoso-rugulosum nitidulumque, subtus rugulosum minus nitidum, sicco rigide coriaceum, 9—10 cm longum, 1.75—2.3 cm latum, petiolo canaliculato, 3—4 cm longo. Inflorescentia 1 ad basin pseudobulborum maturum, erectum, folium bene superans, laxe multiflora, pedunculo 9—12 cm longo, vaginulis c. 7—8 tubulosis superioribus laxioribus longioribusque ad

c. 0.9—1.45 cm longis donato, vaginula summa interdum bracteiformi, rachide 11—12 cm longa, 17—28-flora. Bracteae triangulo-lanceolatae, sensim acutatae, acutae, c. 0.45 cm longae, 0.15 cm latae. Flores parvuli. Sepalum dorsale horizontale, concavum, oblongum, versus apicem angustatum, breviter apiculato-acuminatum, 3-nervium, nervis exterioribus inconspicuis, 0.47 cm longum, basi 0.17 cm latum. Sepala lateralia cum pede gynostemii mentum breve rotundatum faciens, divergentia, oblique oblongo-triangula, margine antico basi paululum dilatato rotundatoque, versus apicem angustata, apice recurvo canaliculato apiculata, 3-nervia, 0.475 cm longa, 0.275 cm lata. Petala gynostemio parallela porrecta, suboblique spathulato-lanceolata, obtusiuscula, parte superiore intus papillosa, 1-nervia, 0.25 cm longa, fere 0.1 cm lata. Labellum mobile, recurvum, parte inferiore lateribus erectis canaliculatum, marginibus in $^1/_3$ supra basin recurvis parte antica convexa, apice angustatum, acutiusculum, linguiforme, carnosulum, maceratum inexpansumque bene 0.3 cm longum. Gynostemium breve, crassum, bene 0.1 cm longum, clinandrio excavato, pariete postico producto lato, auriculis incurvulis subulatis valde acutis antheram aequantibus. Anthera cucullata, apice triangulo-producta. Pes gynostemii cum ovario angulum subrectum faciens, apice incurvo a sepalis libero, callo majusculo lateraliter compresso in dimidio inferiore, 0.17 cm longus. Ovarium pedicellatum 0.24 cm longum; ovarium obconicum, 0.07 cm longum.

Sumatra: Atjeh, Gajolanden, from summit Goh Lemboeh to bivouac Halfweg, 2200 m, ridge in forest (*C. G. G. J. van Steenis n. 9160, type,* in Herb. Buitenz. and Leiden, 23 February 1937; "flowers light yellow"). Leuser complex, great watershed, 2250—2750 m, epiphytical in scrub (*C. G. G. J. van Steenis n. 8483,* in Herb. Buitenz., 30 Jan. 1937).

Among the allied species with distinctly petioled leaves this new one differs from *B. citricolor* J. J. S. in the much longer rhizome, the gradually tapering leaves, the longer and laxer raceme, smaller flowers with the sepals and petals not long acuminate; from *B. petiolatum* J. J. S. in the smaller, narrower, more tapering leaves, a longer and laxer inflorescence, smaller flowers. It is a much slenderer plant than *B. hamatifolium* J. J. S. with narrower, more tapering, acuter, thinner leaves, laxer racemes and much shorter flowers.

In the section *Aphanobulbon* the characteristics of the vegetative parts are very important for distinguishing the species.

Description from herbarium.

Sarcochilus (sect. *Ascochilus*) **spathibrachiatus** J. J. S., n. sp.

Planta pusilla. Caulis abbreviatus, c. 0.6 cm longus, radicans, c. 4-folius. Folia oblique lanceolata, falcata, apice valde oblique acute bidentata, ut videtur carnosa, sicco rigide coriacea, costa media dorso plus minusve prominente, 2.4—2.8 cm longa, 0.47—0.6 cm lata. Inflorescentiae foliis breviores, laxe pauci(?)florae, pedunculo tenui, muriculato, c. 1.1 cm longo, rachide muriculata, haud plane evoluta 0.5 cm longa, internodiis c. 0.2 cm longis. Bracteae reflexae, triangulae, concavae, muriculatae. Flores ? 4, sepalis petalisque dorso sparse patentissime muriculatis. Sepalum dorsale oblongo-ellipticum, subacutum, basin versus angustatum, concavum, 3-nervium, 0.55 cm longum, supra medium 0.2 cm latum. Sepala lateralia valde oblique elliptica, obtusa, basi breviter contracta, leviter concava, 3-nervia, 0.5 cm longa, 0.35 cm, basi 0.16 cm lata. Petala oblique subspathulato-oblonga, obtusa, apice nonnullis dentibus inaequalibus obtusis donata, basin versus angustata, muricibus tantum dorso secundum costam mediam, 3-nervia, fere 0.5 cm longa, 0.175 cm, basi 0.1 cm lata. Labellum apici pedis gynostemii insertum, 3-lobum, calcaratum, totum c. 0.6—0.7 cm, a basi usque ad apicem calcaris 0.45 cm longum; lobi laterales porrecti, gynostemium paululum superantes, leviter oblique spathulati, lineares, apicem versus cuneato-dilatati, apice leviter rotundato-truncati, c. 0.2—0.25 cm longi, apice c. 0.1 cm lati; lobus medius parvus, porrectus, lobis lateralibus bene brevior, rectus, carnosulo-subulatus, obtusiusculus, 0.075 cm longus, callo conspicuo crasso postice laciniis 2 erectis subulatis acutis donato ad basin lobi intermedii inter lobos laterales, laciniis 2 similibus sed minoribus ad basin labelli; calcar dependens, lateraliter compressum (maceratum), oblongum, apice subrotundatum, dorso leviter sigmoideum, antice subrectum, parte superiore subinflatum. Gynostemium arcuatum, clavatum, apice absque anthera truncatum, dorso convexum, subtus concavum, absque anthera bene 0.3 cm longum, clinandrio concavo, pede cum gynostemio angulum obtusum faciente, recto, satis lato, c. 0.2 cm longo. Anthera cucullata, subovata, e basi transverse ovali thecis convexa in rostrum latum triangulum acutum producta, 0.15 cm longa, bene 0.1 cm lata. Stipes pollinarii obovato-oblongus. Rostellum bipartitum, laciniis subulatis. Stigma conspicuum, profunde excavatum, elliptico-obovatum. Ovarium cum gynostemio et pede gynostemii angulos obtusos faciens, patentissime muriculatum, 0.35 cm longum.

British North Borneo: Kinabalu, Penibukan ridge, Upper Pani Taki river, 1700 m (*J. and M. S. Clemens, without number, 1931—'32, type,* "rare, single; petals purple, tongue all cream").

A distinct species of this small section. The plant was sent to me by the Buitenzorg Herbarium for study.

Description from a dried specimen with one flower.

Luisia Jonesii J. J. S., n. sp.

Caulis elongatus, teres, parte adest 12.5 cm longa, sicco 0.35 cm diam., internodiis 2.4—2.8 cm longis. Folia remota, teretia, esulcata, apice breviter acuta cum apiculo parvo reverso obtuso, 16—22 cm longa, 0.3 cm diam.; vaginae tubulosae, internodia paululum superantes, sicco nervis prominentibus. Inflorescentiae axillares, vaginam dorso ad basin perforantes, vaginam inferiorem apice antice rumpentes, abbreviatae, pluriflorae, quaquaversae, c. 2.2 cm longae, rachide valida. Bracteae adpressae, brevissimae, late triangulae, concavae, crassae. Flores c. 10, in genere inter majores, inclinati, c. 2—3 simultanee expansi, carnosi, 3.4 cm longi. Sepalum dorsale gynostemio parallelum, oblongum, obtusum, valde concavum, 5-nervium, nervo medio dorso angulato, 1.4 cm longum, 0.8 cm latum. Sepala lateralia labello parallela, divergentia, inter se angulum acutum facientia, valde cymbiformia, obliqua, dorso bene carinata, carina apice in dentem excurrente, 5-(— sub 7-)nervia, fere 1.4 cm longa. Petala porrecta, apicem ovarii incurvum continua, divergentia, inter se angulum acutum facientia, leviter incurvula, sepala longe superantia, oblique lineari-spathulata, superne vix falcatula, apice breviter contracta, obtusa, intus leviter convexa, dorso praeter costam leviter incrassata, 3-nervia, 3.25 cm longa, basi 0.23 cm, superne 0.5 cm lata. Labellum ovario parallelum, porrectum, 3-lobum, 1.7 cm longum, ad lobos laterales bene 0.7 cm, expansum 0.775 cm latum; lobi laterales remoti, parvi, leviter divergentes, rotundati, basi in lobulum parvum reversum obtusum producti, fere 0.3 cm lati; lobus intermedius multo major, late cordato-ovatus, basi sulco semiorbiculari instructus, ante sulcum valde convexus, medio a sulco semiorbiculari sulcis 4 longitudinalibus tenuibus, nonnullis sulcis subobsoletis ad marginem, margine irregularis, apice rotundatus, lobulis basilaribus rotundato-triangulis, 1.6 cm longus, 1.35 cm latus. Gynostemium breve, crassum, rectum, bene semiteres, dorso convexum, subtus planum, basi subcontractum, 0.5 cm longum, clinandrio concavo cum costula longitudinali, apice paululum producto obtuso. Anthera cucullata, transverse rotundato-quadrangula, versus apicem leviter dilatata, paululum producta truncatave, connectivo convexo-costiformi, 0.35 cm lata. Pollinia 2, ovalia, dorso profunde sulcata, cum stipite lato pollinia aequante subovato obtuso et glandula conspicua lata 0.4 cm longa. Stigma magnum, faciem inferiorem gynostemii magnam partem occupans, transverse ovale, alte concavum. Ovarium pedicellatum triquetrum, costa lata convexa in lateribus, 6-sulcatum, basin versus attenuatum et tortum, apice obtusangule incurvum, 2 cm longum.

Malay Peninsula: Kedah (*J. W. Jones, type* in Herb. Leiden).

Materials of this interesting *Luisia* I received for determination from the Director of the Botanic Gardens, Singapore, where the only plant, found by Mr. Jones, is now cultivated.

The species belongs to those which produce the biggest flowers in the genus. The nearest ally is probably *L. taurina* J. J. S. from Java, from which it differs in the larger flowers with relatively narrower petals. The lip has smaller sidelobes, and the much less rugose midlobe is distinctly wider than the hypochile.

I am indebted to Mr. R. E. Holttum for the following notes:

"Inflorescences about 10-flowered of which 2—3 flowers are open at one time. Sepals upper surface cream, lower surface pale greenish with small scattered purple spots. Petals basal $^{2}/_{3}$ cream, as sepals; distal $^{1}/_{3}$ dull yellow. Lip entirely dark purple, except for cream margins of sidelobes, and narrow irregular cream line dividing the semicircular basal part from the rest. Semi-circular basal part with dull surface; remainder shining."

Description from herbarium and materials in spirit.

Taeniophyllum Jensenianum J. J. S., nom. nov. — *T. amboinense* J. J. S. in Bull. Jard. Bot. Buit. 3e sér. VIII (1926), 68.

The name *T. amboinense*, having been used previously (Ic. Orch. Mal. t. 139, VI), had to be changed.

NEW LOCALITIES.

Herminium angustifolium Bth. ex Hook. f., Fl. Br. Ind. VI (1890), 129; etc.

Bali: Goenoeng Agoeng, southern slope, 1500—2000 m, very common in grassfields (*C. G. G. J. van Steenis n. 7849*, in Herb. Buitenz., 6 April 1936).

Habenaria multipartita Bl. ex Krzl. in Engl., Bot. Jahrb. XVI (1893), 193; etc.

Bali: Goenoeng Agoeng, southern slope, 1800—2000 m, grass-fields, common (*C. G. G. J. van Steenis n. 7789*, in Herb. Buitenz., 6 April 1936).

Thelymitra javanica Bl., Bijdr. (1825), 419; etc.

Lombok: Goenoeng Rindjani, northern slope, 1800—2600 m, rather common (*R. van der Veen n. 11*, in Herb. Buitenz., July 1936). Same locality, 1300 m, dry grass-field (*C. N. A. de Voogd n. 1701*, in Herb. Buitenz., 25 June 1933; "flowers light violet").

Microtis unifolia Rchb. f., Beitr. Syst. Pflanzenk. (1871), 62; etc.

Bali: Goenoeng Abang, 1300—1550 m, grass-fields and road sides, with *Herminium* (*C. G. G. J. van Steenis n. 8005*, in Herb. Buitenz., etc., 9 April 1936).

Caladenia carnea R. Br., Prodr. (1820), 324; etc.

Bali: Goenoeng Abang, 1400—1550 m, grass-fields and berms along the path (*C. G. G. J. van Steenis n. 8003*, in Herb. Buitenz. and Leiden, 9 April 1936).

Myrmechis gracilis Bl., Fl. Jav. n. ser. I, Orch. (1858), 64, t. 21, fig. 2; etc.

Bali: Goenoeng Agoeng, southern slope, 1800 m, damp ravine (*C. G. G. J. van Steenis n. 7924*, in Herb. Buitenz., etc., April 1936).

Goodyera rubicunda Lndl. in Bot. Reg. XXV (1839), Misc. 61; etc.

Lombok: Goenoeng Rindjani, Sapit, 800 m, old forest (*C. N. A. de Voogd n. 2588*, in Herb. Buitenz., 13 June 1936).

Goodyera procera Hook., Exot. Fl. I (1823), t. 39; etc.

Flores: Manggarai, 300 m, in a ravine (*C. N. A. de Voogd n. 2857*, in Herb. Buitenz. and Leiden, 18 September 1936).

Goodyera bifida Bl., Fl. Jav. n. ser. I, Orch. (1858), 33, t. 9 C, fig. 1; etc.

Bali: Goenoeng Abang, 1800 m, edge of the forest (*C. N. A. de Voogd n. 2763*, in Herb. Buitenz., 24 March 1936; *C. G. G. J. van Steenis n. 8067*, in Herb. Buitenz., 9 April 1936).

Goodyera reticulata Bl., Fl. Jav. n. ser. I, Orch. (1858), 30, t. 9 B, fig. 1; etc.

Bali: G. Batoe Kaoe and G. Patas (*R. Maier, Sarip n. 393*, in Herb. Buitenz., 1918). North of the Bratan lake, 1250 m, damp old forest (*C. G. G. J. van Steenis n. 8155*, in Herb. Buitenz., 12 April 1936; 2 week specimens).

Coelogyne miniata Lndl., Gen. et Sp. Orch. (1830), 42; etc.

Bali: Goenoeng Abang, 1700—2000 m, damp forest, common (*C. G. G. J. van Steenis n. 8040*, in Herb. Buitenz., 9 April 1936; *C. N. A. de Voogd n. 2770*, in Herb. Buitenz., 24 March 1936).

Dendrochilum cornutum Bl., Bijdr. (1825), 339; etc.

Bali: Goenoeng Abang, 1700—2000 m, epiphytical in forest, also in *Casuarina* forest, common (*C. G. G. J. van Steenis n. 8070*, in Herb. Buitenz., 9 April 1936). G. Batoe Kaoe, 1750 m (*R. Maier, Sarip n. 429*, in Herb. Buitenz., October 1918).

Tainia Maingayi Hook. f., Fl. Brit. Ind. V (1890), 822; Ic. t. 2094; etc.

Sumatra: West coast, Ngalau Oere, 600 m (*S. M. Latif s. n.*, in Herb. Leiden, 17 July 1939).

Liparis purpureo-viridis Burk. ex Ridl., Fl. Mal. Penins. IV (1924), 21.

Sumatra: West coast, Ngalau Oere, 600 m (*S. M. Latif. n. I*, in Herb. Leiden, 17 July 1939).

Pachystoma pubescens Bl., Bijdr. (1825), 376; Tab. fig. 29; etc.

Flores: Manggarai, 500 m, in *Imperata*-fields (*C. N. A. de Voogd n. 2856*, in Herb. Buitenz., dupl. in Herb. Leiden, 18 September 1936).

Eria javanica Bl., Rumphia II (1836), 23; etc.

Flores: Manggarai (*C. N. A. de Voogd n. 2844*, in Herb. Buitenz., 16 Sept. 1936).

Dendrobium (sect. *Diplocaulobium*) **longicolle** Lndl. in Bot. Reg. XXVI (1840), Misc. 74; Rchb. f. in Walp. Ann. VI (1861), 302; Ridl. in Mat.

Fl. Mal. Penins. I (1907), 34. — *Diplocaulobium longicolle* Krzl. in Pflanzenr. IV. 50. II. B. 21 (1910), 340; Ridl., Fl. Mal. Penins. IV (1924). 27. — *Callista longicollis* O. K., Rev. Gen. Pl. II (1891), 654.

Sumatra: Palembang, Pladjoe *(P. van Hemert,* cult. in Hort. Bog. sub n. 930. VII. 52).

Geogr. distribution: Singapore, Borneo.

The species is new for Sumatra. It is the most western representative of the section.

Dendrobium faciferum J. J. S. in Bull. Dép. Agric. Ind. Néerl. XV (1908), 10.

Lesser Soenda Islands: Komodo, 300 m, marshy forest *(C. N. A. de Voogd n. 2871,* in Herb. Buitenz., 20 September 1936).

Bulbophyllum gracile Lndl., Gen. et Sp. Orch. (1830), 50; etc.

Bali: Goenoeng Abang, southern slope, 1800 m, dampy underwood in a ravine (*C. G. G. J. van Steenis n. 7927,* in Herb. Buitenz., 7 April 1936).

Eulophia squalida Lndl. in Bot. Reg. XXVII (1841), Misc. 77; etc.

Lesser Soenda Islands: West Soemba, 400 m, *Imperata*-fields (*C. N. A. de Voogd n. 2229,* in Herb. Buitenz., 5 November 1935).

Eulophia exaltata Rchb. f. in Bonpl. V (1857), 38; etc.

Flores: Endeh, 1000 m, marshy *Imperata*-land, in full sunshine (*Mrs. E. H. Winckel—Sweep,* in Herb. Buitenz., January 1939).

According to Oakes Ames this plant should be identical with *Eu. stricta* (Presl) Ames.

Vanda tricuspidata J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIII (1914), 48; etc.

Flores: Endeh, 50 m, hot, barren plain (*Mrs. E. H. Winckel—Sweep,* in Herb. Buitenz., January 1939).

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LIST OF ORCHIDACEAE COLLECTED IN 1937 BY Dr C. G. G. J. VAN STEENIS IN ATJEH (NORTH SUMATRA).[1]

by

J. J. SMITH

(Oegstgeest).

(Issued April 15th, 1943).

Platanthera angustata (Bl.) Lndl., Gen. et sp. Orch. (1835), 290; etc.

Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, bivouac 1 to 2, 2700 m, blang ground, marshy heath, common (*C. G. G. J. van Steenis n. 8350*, 28 Jan. 1937). G. Leuser, bivouac 4—5, watershed, 2700—2800 m (*C. G. G. J. van Steenis n. 8502*, 31 Jan. 1937). Same locality, central top, Aloer near bivouac 6, 3250—3300 m, mountain meadow (*C. G. G. J. van Steenis n. 8633*, 3 Febr. 1937). G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1000 m (*C. G. G. J. van Steenis n. 8902*, 8 Febr. 1937).

Platanthera Blumei Lndl., Gen. et sp. Orch. (1835), 290; etc.

Sumatra: Atjeh, Gajolanden, summit G. Kemiri to bivouac Aloer, on the east slope, 3300—2850 m, forest ridge and plateau (*C. G. G. J. van Steenis n. 9686*, 10 March 1937).

The material is in bud only, but the spur is clavate and blunt.

Cryptostylis ?conspicua J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 247; V (1922), t. 24, II.

Sumatra: Atjeh, Gajolanden, Goh Lemboeh, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1600 m, forest ridge (*C. G. G. J. van Steenis n. 9202*, 24 Febr. 1937).

Not quite certain.

Epipogium roseum Lndl. in Journ. Linn. Soc. I (1857), 177; etc.

Sumatra: Atjeh, Gajolanden, from bivouac 3, on the confluence of K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m, flat forest ridges with cold sulphurous spring fields (*C. G. G. J. van Steenis n. 9987*, 21 March 1937). Foot of G. Kemiri, bivouac 1 via Goempang to Kongke, 900 m (*C. G. G. J. van Steenis, n. 9773*, 12 March 1937).

Galeola Lindleyana Rchb. f., Xenia Orch. II (1862), 78; etc.

Sumatra: Atjeh, Gajolanden, from Sanger, bivouac 2 to bivouac 3 on the confluence of K. Kapi and K. Aoenan, 1100 m, humid primeval forest (*C. G. G. J. van Steenis n. 9881*, 20 March 1937).

Aphyllorchis ?pallida Bl., Bijdr. (1825); Tab. fig. 77; etc.

Sumatra: Atjeh, Gajolanden, foot of G. Kemiri, bivouac 1 via Goempang to Kongke, 900 m (*C. G. G. J. van Steenis n. 9772*, 12 March 1937). From Sanger, bivouac 2 to bivouac 3 on the confluence of K. Kapi and K. Aoenan, 1100 m, flat forest ridges (*C. G. G. J. van Steenis n. 9908*, 20 March 1937). From bivouac 7 to West via Aer Panas to Roema Boender on the transport path near paal 66/67 and along the Lau Alas to G. Setan, 1000 m, humid forest slope (*C. G. G. J. van Steenis n. 10086*, 24 March 1937).

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[1] This paper was originally intended to be published in the Bulletin of the Government Botanic Garden, Buitenzorg, but the war prevented me from doing so and made me request the hospitality of "Blumea".

Anoectochilus ?longicalcaratus J. J. S. in Bull. Jard. Bot. Buit. 3e sér. V (1922), 18; Suppl. II (1930), t. 9, I.

Sumatra: Atjeh, Gajolanden, G. Kemiri, eastern slope, bivouac 1 to 2, 2850 m, forest ridge (*C. G. G. J. van Steenis n. 9559*, 6 March 1937). From bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, moss-grown forest (*C. G. G. J. van Steenis n. 10042*, 23 March 1937).

Odontochilus sumatranus J. J. S. in Blumea V^2 (1943), 298.

Sumatra: Atjeh, Gajolanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, moss-grown forest (*C. G. G. J. van Steenis n. 10043*, 23 March 1937).

Myrmechis gracilis Bl., Fl. Jav. n. ser. I Orch. (1858), 64, t. 21, fig. 2; etc.

Sumatra: Atjeh, Gajolanden, G. Kemiri, eastern slope, bivouac 1 to 2, 2500—2850 m, forest ridge, moss-grown forest, common (*C. G. G. J. van Steenis n. 9560*, 6 March 1937). Summit G. Kemiri to bivouac Aloer on the east side, 3300—2850 m, forest ridge and plateau in moss-cushions (*C. G. G. J. van Steenis n. 9703*, 10 March 1937).

Hetaeria grandiflora Ridl. in Journ. Mal. Br. R. As. Soc. I (1923), 98; etc.

Sumatra: Atjeh, Gajolanden, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1000 m, forest ridge (*C. G. G. J. van Steenis n. 9198*, 24 Febr. 1937).

Erythrodes latifolia Bl., Bijdr. (1825), 411; Tab. fig. 72; etc.

Sumatra: Atjeh, Gajolanden, from bivouac 2, Sanger to bivouac 3 on the confluence of K. Kapi and K. Aoenan, 1100 m, flat forest ridges (*C. G. G. J. van Steenis n. 9901*, 20 March 1937).

Dicerostylis lanceolata Bl., Fl. Jav. n. ser. I (1858), 98, t. 38, fig. 1; etc.

Sumatra: Atjeh, Gajolanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, wet forest (*C. G. G. J. van Steenis n. 10040*, 23 March 1937).

Goodyera ?viridiflora Bl., Fl. Jav. n. ser. I, Orch. (1858), 34, t. 9, fig. 2; etc.

Sumatra: Atjeh, Gajolanden, from Sanger, bivouac 2 to bivouac 3 on the confluence of K. Kapi and K. Aoenan, 1100 m, flat forest ridges (*C. G. G. J. van Steenis n. 9909*, 20 March 1937).

Only a weak specimen with one flower.

Goodyera secundiflora Lndl. in Journ. Linn. Soc. I (1857), 182; etc.

Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, forest slope above Penosan, 2000 m, ericoid ridge (*C. G. G. J. van Steenis n. 8314*, 27 Jan. 1937); Leuser complex, bivouac 2 to 3, Lau Alas upper course, 2100—2250 m, moss-grown forest (*C. G. G. J. van Steenis n. 8435*, 29 Jan. 1937; "leaf light green, mottled, flower white").

Goodyera ?pusilla Bl., Fl. Jav. n. ser. I, Orch. (1858), 31, t. 9 B, fig. 3; etc.

Sumatra: Atjeh, Gajolanden, from Palo to Kongke, 1000 m, open forest (*C. G. G. J. van Steenis n. 9432*, 4 March 1937).

Tropidia angulosa Bl., Orch. Arch. Ind., 122; etc.

Sumatra: Atjeh, Gajolanden, from Pendeng to bivouac Aer Poetih waterfall, 500 m, humid primeval forest (*C. G. G. J. van Steenis n. 8875*, 17 Febr. 1937; "flower white"). Bivouac Aer Poetih waterfall to Pendeng, 400—500 m, primeval forest (*C. G. G. J. van Steenis n. 9300*, 25 Febr. 1937; "flower white").

Tropidia pedunculata Bl., Fl. Jav. nov. ser. I, Orch. (1858), 103; t. 40; etc.

Sumatra: Atjeh, Gajolanden, Goh Lemboch, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1400 m (*C. G. G. J. van Steenis n. 8926*, 18 Febr. 1937; "flower light orange"). Same locality, 1000 m, forest ridge (*C. G. G. J. van Steenis n. 9217*, 24 Febr. 1937; "flower white").

Nephelaphyllum pulchrum Bl., Bijdr. (1825), 373; Tab. fig. 22; etc.
Sumatra: Atjeh, Gajolanden, G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1000 m, forest ridge (*C. G. G. J. van Steenis n. 8895*, 18 Febr. 1937; "flower pale, leaf mottled").

Tainia (sect. *Ascotainia*) **Steenisii** J. J. S. in Blumea V² (1943), 306.
Sumatra: Atjeh, Gajolanden, G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1400 m, forest ridge (*C. G. G. J. van Steenis n. 8960*, 18 Febr. 1937).

Tainia sumatrana J. J. S. in Bull. Jard. Bot. Buit. 3e sér. V (1922), 24; Suppl. II (1930), t. 22, IV.
Sumatra: Atjeh, Gajolanden, Goh Lemboeh, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1200 m, forest ridge (*C. G. G. J. van Steenis n. 9216*, 24 Febr. 1937).

Coelogyne salmonicolor Rchb. f. in Gard. Chr. n. s. XX (1883), 328; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 3 on the confluence of K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m, flat forest ridges with cold sulphurous spring fields (*C. G. G. J. van Steenis n. 9930*, 21 March 1937).

Coelogyne (sect. *Cristatae*) **kemiriensis** J. J. S. in Blumea V² (1943), 298.
Sumatra: Atjeh, Gajolanden, summit Goh Lemboeh, 3000 m, moss-grown forest (*C. G. G. J. van Steenis n. 9054*, 20 Febr. 1937; "flower white with a brown stain in throat"). G. Kemiri, eastern slope, bivouac 2 to summit, 2900—3314 m, forest ridge and plateau (*C. G. G. J. van Steenis n. 9636*, 7 March 1937; "flower white with some brown markings on the keels of the lip, terrestrial Orchid").

Pholidota (sect. *Crinonia*) **rupestris** J. J. S. in Blumea V² (1943), 300.
Sumatra: Atjeh, Gajolanden, G. Leuser, central top, bivouac 6, 3300—3500 m, stony spots and rocks on the top (*C. G. G. J. van Steenis nrs. 8578* and *8579*, 2 Febr. 1937).

Dendrochilum simile Bl., Bijdr. (1825), 400; Tab. fig. 51; etc.
Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, forest slope above Penosan, 1500 m, ridge, mountain forest (*C. G. G. J. van Steenis n. 8279*, 27 Febr. 1937).

Dendrochilum longibracteatum Pfitz. in Pflanzenr. IV. 50. II. B. 7 (1907), 106, fig. 35 M.
Sumatra: Atjeh, Gajolanden, Leuser complex, bivouac 3 to 4, great watershed, 2250—2750 m, blang grounds (*C. G. G. J. van Steenis n. 8466*, 30 Jan. 1937).

Dendrochilum (sect. *Platyclinis*) **rhombeum** J. J. S. in Blumea V² (1943), 304.
Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, forest slope above Penosan, 1500 m, forest ridge (*C. G. G. J. van Steenis n. 8320*, 27 Jan. 1937).

Dendrochilum (sect. *Platyclinis*) **quinquangulare** J. J. S. in Blumea V² (1943), 305.
Sumatra: Atjeh, Gajolanden, G. Leuser, 2700—2800 m, watershed, bivouac 4 to 5, brook valley (*C. G. G. J. van Steenis n. 8492*, 31 Jan. 1937). Central top, bivouac 6, 3300—3500 m, rocks of the top (*C. G. G. J. van Steenis n. 8580*, 2 Febr. 1937). Summit Goh Lemboeh, 3000 m, blang, on rocks (*C. G. G. J. van Steenis n. 9080*, 21—22 Febr. 1937).

Dendrochilum (sect. *Platyclinis*) **atjehense** J. J. S. in Blumea V² (1943), 302.
Sumatra: Atjeh, Gajolanden, G. Leuser, bivouac 4—5, 2700—2800 m, watershed (*C. G. G. J. van Steenis n. 8540*, 31 Jan. 1937).

Dendrochilum (sect. *Platyclinis*) **fimbrilobum** J. J. S. in Blumea V² (1943), 303.
Sumatra: Atjeh, Gajolanden, from summit Goh Lemboeh to bivouac Halfweg, 2400 m, forest ridge (*C. G. G. J. van Steenis n. 9159*, 23 Febr. 1937).

Dilochia Cantleyi Ridl. in Journ. Linn. Soc. XXXII (1896), 332; etc.
Sumatra: Atjeh, Gajolanden, from top Goh Lemboeh to bivouac Halfweg, 2100 m, forest ridge (*C. G. G. J. van Steenis n. 9165,* 23 Febr. 1937; "flower cream-colour, lip brimstone-yellow, faintly striped dirty violet").

Arundina speciosa Bl., Bijdr. (1825), 401; Tab. fig. 73; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, 2000 m, grassy slope on burnt ridge, common (*C. G. G. J. van Steenis n. 8736,* 8 Febr. 1937).

Sarcostoma ?javanica Bl., Bijdr. (1825), 340; Tab. fig. 45; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 9 via the Agoesan ridge to Blang Kedjeren, 2600 m, G. Senoebong (*C. G. G. J. van Steenis n. 8751,* 7 Febr. 1937).

Ceratostylis grandiflora J. J. S. in Rec. trav. bot. Néerl. I (1904), 156, cum fig.
Sumatra: Atjeh, Gajolanden, Leuser complex, bivouac 2 to 3, Lau Alas upper course, 2100—2250 m, moss-grown forest (*C. G. G. J. van Steenis n. 8433,* 29 Jan. 1937).

Ceratostylis (sect. *Pleuranthemum*) **Steenisii** J. J. S. in Blumea V^2 (1943), 307.
Sumatra: Atjeh, Gajolanden, G. Kemiri, east side, from bivouac Aloer to bivouac 1, 2800—3000 m, moss-grown forest on the ridge (*C. G. G. J. van Steenis n. 9742,* 11 March 1937; "flower white").

var. **latipetala** J. J. S. in Blumea V^2 (1943), 308.
Sumatra: Atjeh, Gajolanden, summit Goh Lemboeh, 3000 m (*C. G. G. J. van Steenis n. 9077,* 20 Febr. 1937; "flower white").

Ceratostylis ?ampullacea Krzl. in Bot. Jahrb. XVII (1893), 487; etc.
Sumatra: Atjeh, Gajolanden, from summit Goh Lemboeh to bivouac Halfweg, 1850 m, on stump in low coppice (*C. G. G. J. van Steenis n. 9141,* 23 Febr. 1937).

Podochilus tenuis Lndl., Gen. et sp. Orch. (1833), 235; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 7 to the west via Aer Panas to Roema Boender, on the trail near paal 66/67, and along the Lau Alas to G. Setan, humid forest slope (*C. G. G. J. van Steenis n. 10101,* 24 March 1937; "flower white").

Appendicula pendula Bl. ?var. **obtusa** J. J. S. in Bull. Jard. Bot. Buit. 2e ser. XIV (1914), 40.
Sumatra: Atjeh, Gajolanden, from bivouac Paja (5) to bivouac Meer (6), 1250—1500 m, forest (*C. G. G. J. van Steenis n. 10009,* 22 March 1937).

Calanthe angustifolia Lndl., Gen. et sp. Orch. (1833), 251; etc.
Sumatra: Atjeh, Gajolanden, G. Kemiri, east side, from bivouac Aloer to bivouac 1, 2000 m, forest ridge (*C. G. G. J. van Steenis n. 9754,* 11 March 1937; "flower white, midlobe lip golden-yellow").

Calanthe (sect. Styloglottis) **atjehensis** J. J. S. in Blumea V^2 (1943), 308.
Sumatra: Atjeh, Gajolanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, narrow ridge, moss-grown forest (*C. G. G. J. van Steenis n. 10057,* 23 March 1937; "flower orange, very beautiful plant").

Phajus flavus Lndl., Gen. et sp. Orch. (1831), 128; etc.
Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, forest slope above Penosan, 1500—2000 m (*C. G. G. J. van Steenis nrs. 8266* and *8303,* 27 Jan. 1937; "flower white").

Spathoglottis plicata Bl., Bijdr. (1825), 401; Tab. fig. 76; etc.
Sumatra: Atjeh, Gajolanden, from Kongke via Goempang to bivouac 1 on east slope of G. Kemiri, 1200 m, sand and gravel bank, very steep (*C. G. G. J. van Steenis n. 9515,* 5 March 1937).

Spathoglottis aurea Lndl. in Paxt., Fl. Gard. I (1850), 16; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 3 on the confluence of K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m, flat forest ridges with sulphurous spring fields, swamp Paja Kapi (*C. G. G. J. van Steenis n. 9943,* 21 March 1937; "flower golden yellow").

Eria ?robusta Lndl., Gen. et sp. Orch. (1830), 69; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 3 on the confluence of K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m, flat forest ridges, mountain swamp Paja Kapi (*C. G. G. J. van Steenis n. 9965,* 21 March 1937).

var. **pilosipetala** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. XII (1932), 124.
Sumatra: Atjeh, Gajolanden, G. Leuser, bivouac 4 to 5, watershed, 2700—2800 m, open rocky plains in mountain heath (blang) (*C. G. G. J. van Steenis n. 8507* 31 Jan. 1937; "flower rose colour"). From bivouac Halfweg to bivouac summit Goh Lemboeh, 2800 m, forest ridge, moss-grown forest (*C. G. G. J. van Steenis n. 8981,* 17 Febr. 1937; "flower inside light green, outside light brown, column blackish red").

Eria appendiculata Lndl., Gen. et sp. Orch. (1830), 69; etc.
Sumatra: Atjeh, Gajoelanden, from bivouac Paja (5) to bivouac Meer (6), 1250—1500 m, forest (*C. G. G. J. van Steenis n. 10011,* 22 March 1937).

Eria pachystachya Lndl. in Journ. Linn. Soc. III (1859), 60; etc.
Sumatra: Atjeh, Gajoelanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, edge of the lake, epiphytical (*C. G. G. J. van Steenis n. 10048,* 23 March 1937; "flower rose colour").

Eria ?palmifolia Ridl. in Journ. Fed. Mal. St. Mus. VIII (1917), 99; etc.
Sumatra: Atjeh, Gajoelanden, G. Leuser, watershed, 2700—2800 m, moss-grown forest (*C. G. G. J. van Steenis n. 8533,* 31 Jan. 1937; "flower rose colour"). From bivouac Halfweg to bivouac summit Goh Lemboeh, forest ridge, moss-grown forest (*C. G. G. J. van Steenis n. 8982,* 17 Febr. 1937; "flower rose-coloured, column wine-red").

Eria schistoloba Schltr. in Bot. Jahrb. XLV (1911), Beibl. No. 104, 38; etc.
Sumatra: Atjeh, Gajolanden, from bivouac Laoet Tiga Sagi (6) and Pasir Lebar to bivouac 7, 1300—1500 m, edge of lake (*C. G. G. J. van Steenis n. 10049,* 23 March 1937: "flower yellow").

Eria rhinoceros Ridl. in Journ. Fed. Mal. St. Mus. VIII (1917), 99; etc.
Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, forest slope above Penosan, 2000 m, ericoid ridge on stumps frequently (*C. G. G. J. van Steenis n. 8307,* 27 Jan. 1937; "flower white"). Leuser complex, bivouac 3 to 4, great watershed, 2250—2750 m, blang grounds on rocks (*C. G. G. J. van Steenis n. 8467,* 30 Jan. 1937).

The leaves are much narrower than in other localities in Sumatra, perhaps due to the barren situation.

Eria pilifera Ridl. in Journ. Linn. Soc. XXXII (1896), 299; etc.
Sumatra: Atjeh, Gajolanden, from Paloh to Kongke, 1000 m (*C. G. G. J. van Steenis n. 9481,* 4 March 1937).

Eria ferox Bl., Mus. II (1856), 184; etc.
Sumatra: Atjeh, Gajolanden, from bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, forest slope, 2000 m (*C. G. G. J. van Steenis n. 8737,* 8 Febr. 1937).

Eria velutina Lodd. ex Lndl. in Bot. Reg. XXVI (1840), Misc. 86; etc.
Sumatra: Atjeh, Gajolanden, Goh Lemboeh, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1000 m, forest ridge (*C. G. G. J. van Steenis n. 9248,* 24 Febr. 1937).

Eria poculata Ridl. in Journ. Linn. Soc. XXXII (1896), 305; etc.
Sumatra: Atjeh, Gajolanden, G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1500 m, forest ridge, epiphytical (*C. G. G. J. van Steenis n. 8900,* 18 Febr. 1937).

Dendrobium Wichersii Schltr. in Fedde Rep. VIII (1910), 506; etc.
Sumatra: Atjeh, Gajolanden, from summit Goh Lemboeh to bivouac Halfweg, 2000 m, forest ridge (*C. G. G. J. van Steenis n. 9164,* 23 Febr. 1937). From bivouac 3 on the confluence of K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m, flat forest ridges with cold sulphurous spring fields, Paja Kapi swamp (*C. G. G. J. van Steenis n. 9940,* 21 March 1937).

Dendrobium brevibulbum J. J. S. in Bull. Jard. Bot. Buit. 3e sér. X (1928), 62; etc.

Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, bivouac 1 to 2, 2300—2700 m, on trees, shrubs and rocks, common (*C. G. G. J. van Steenis n. 8344*, 28 Jan. 1937). G. Leuser, central top, bivouac 6, 3300—3500 m, on stony spots, rocks, also in moss-grown forest, but there commonly stronger (*C. G. G. J. van Steenis n. 8582*, 2 Febr. 1937). From bivouac Halfweg to bivouac summit Goh Lemboeh, 2000—3040 m, forest ridge, epiphytical and on rocks, common (*C. G. G. J. van Steenis nrs. 9026* and *9161*, 19 and 23 Febr. 1937). Goh Lemboeh, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1400 m, forest ridge (*C. G. G. J .van Steenis n. 9234*, 24 Febr. 1937). G. Kemiri, east slope, bivouac 2 to summit, 2900—3314 m, forest ridge and plateau, on rocks (*C. G. G. J. van Steenis n. 9616*, 7 March 1937).

Dendrobium pedicellatum J. J. S. in Bull. Dép. Agric. Ind. Néerl. XV (1908), 13; etc.

Sumatra: Atjeh, Gajolanden, from bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, 2000 m, mountain ridge (*C. G. G. J. van Steenis n. 8762*, 8 Febr. 1937). From summit Goh Lemboeh to bivouac Halfweg, 2000 m, forest ridge (*C. G. G. J. van Steenis n. 9166*, 23 Febr. 1937; "flower white, lip leather-yellow with a white tip").

Dendrobium Hasseltii Lndl., Gen. et sp. Orch. (1830), 81; etc.

Sumatra: Atjeh, Gajolanden, Poetjoek Angasan, bivouac 1 to 2, 2300—2700 m, in shrubs on ridge, common but scattered (*C. G. G. J. van Steenis n. 8342*, 28 Jan. 1937). G. Leuser, bivouac 4 to 5, watershed, 2700—2800 m, on the blang, also in moss-grown forest (*C. G. G. J. van Steenis n. 8500*, 31 Jan. 1937; "flower purple with an orange spot on the lip"). G. Kemiri, east slope, bivouac 1 to 2, 1800—2500 m; forest ridge (*C. G. G. J. van Steenis n. 9535*, 6 March 1937).

Bulbophyllum membranifolium Hook. f. Fl. Br. Ind. V (1890), 706; Ic. pl. XXI (1892), t. 2034; etc.

Sumatra: Atjeh, Gajolanden, from bivouac Halfweg to bivouac Goh Lemboeh, 2700 m, moss-grown forest, epiphytical, not rare (*C. G. G. J. van Steenis n. 9027*, 19 Febr. 1937; "flower brimstone-yellow with brown-red streaks").

Bulbophyllum uniflorum Hassk., Cat. Bog. (1844), 39; etc.

Sumatra: Atjeh, Gajolanden, from bivouac Halfweg to bivouac Goh Lemboeh, 2700 m (*C. G. G. J. van Steenis*, mixed with *n. 9027*, 19 Febr. 1937).

Bulbophyllum lasianthum Lndl. in Gard. Chr. 1855, 53; etc.

Sumatra: Atjeh, Gajolanden, Goh Lemboeh, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1200 m, forest ridge (*C. G. G. J. van Steenis n. 9241*, 24 Febr. 1937).

Bulbophyllum laxiflorum Lndl., Gen. et sp. Orch. (1830), 57; etc.

Sumatra: Atjeh, Gajolanden, from bivouac Paja (5) to bivouac Meer (6), 1250—1500 m (*C. G. G. J. van Steenis n. 10008*, 22 March 1937).

Bulbophyllum croceum Lndl., Gen. et sp. Orch. (1830), 57; etc.

Sumatra: Atjeh, Gajolanden, from bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, 1800—2000 m, abundant in coppice on mountain ridge (*C. G. G. J. van Steenis n. 8764*, 8 Febr. 1937; "flower brimstone-yellow").

Very strong specimens.

Bulbophyllum (sect. Aphanobulbon) **gajoense** J. J. S. in Blumea V^2 (1943), 309.

Sumatra: Atjeh, Gajolanden, from summit Goh Lemboeh to bivouac Halfweg, 2200 m, forest ridge (*C. G. G. J. van Steenis n. 9160*, 23 Febr. 1937; "flower light yellow"). Leuser complex, great watershed, 2250—2750 m, epiphytical in coppice (*C. G. G. J. van Steenis n. 8483*, 30 Jan. 1937).

Bulbophyllum auroreum J. J. S. var. **grandiflorum** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. XII (1932), 143.

Sumatra: Atjeh, Gajolanden, Leuser complex, bivouac 2 to 3, Lau Alas upper course, 2100—2250 m, moss-grown forest (*C. G. G. J. van Steenis n. 8432*, 29 Jan. 1937; "flower leather-yellow with orange lip"). From bivouac Halfweg to bivouac Goh Lemboeh, 2500 m, moss-grown forest, forest ridge (*C. G. G. J. van Steenis n. 8979,* 19 Febr. 1937; "inflorescence pale orange, lip orange").

Cymbidium chloranthum Lndl. in Bot. Reg. XXIX (1843), Misc. p. 68; etc.

Sumatra: Atjeh, Gajolanden, Leuser complex, bivouac 2 to 3, Lau Alas upper course, 2100—2250 m, mountain heath (blang), on the ground, frequent, beautiful plant (*C. G. G. J. van Steenis n. 8424,* 29 Jan. 1937).

Thelasis micrantha J. J. S. in Fl. Buit. VI (1905), 495; Fig. Atl. fig.CCCLXXIV; etc.

Sumatra: Atjeh, Gajloanden, Goh Lemboeh, from bivouac Halfweg to bivouac Aer Poetih waterfall, 1000 m, forest ridge (*C. G. G. J. van Steenis n. 9214,* 24 Febr. 1937).

Thelasis obtusa Bl. Bijdr. (1825), 386; etc.

Sumatra: Atjeh, Gajolanden, from bivouac Paja (5) to bivouac Meer (6), 1250—1500 m, forest (*C. G. G. J. van Steenis n. 10010,* 22 March 1937).

Phalaenopsis pulcherrima J. J. S. in Fedde, Rep. XXXII (1933), 366; etc.

Sumatra: Atjeh, Gajolanden, Gadjah via Oreng to Pendeng, 1000—1400 m, very characteristic for grass-plots in open fir woods, numerous, terrestrial Orchid (*C. G. G. J. van Steenis nrs. 8820* and *9332,* 16 and 26 Febr. 1937; "flower rose colour with markings").

The following numbers could not be determined on account of the insufficient material.

8407 — **Bulbophyllum** spec. (sect. *Aphanobulbon*). Poetjoek Angasan, 2400—2700 m. Probably = *n. 9163* = *9753.*
8438 — **Dendrobium** spec. (sect. *Rhopalanthe*). Leuser complex, upper course Lau Alas, 2100—2250 m.
8705 — **Bulbophyllum** ? n. sp. (sect. *Aphanobulbon*). From bivouac 8 to 9 on the Lau Alas, 2400 m.
8732 — **Dendrochilum** spec. (sect. *Monochlamys*). From bivouac 8 to 9 on the Lau Alas, 2000 m, common.
8751 — (mixed with) **Taeniophyllum** spec.
8761 — **Paphiopedilum** ? n. sp. From bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, above Kongke, 1100 m.
8771 — **Lecanorchis** spec. From bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, 1500 m.
8781 — **Calanthe** n. sp. (sect. *Eucalanthe*). From bivouac 9 on the Lau Alas via the Agoesan ridge to Blang Kedjeren, 2000 m.
8839 — **Plocoglottis** spec. Gadjah via Oreng to Pendeng, 600 m.
8905 — **Anoectochilus** spec. G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1500 m.
8946 — **Dendrobium** spec. (sect. *Oxystophyllum*). G. Goh Lemboeh, from bivouac Aer Poetih waterfall to bivouac Halfweg, 1500 m.
9142 — **Ceratostylis** spec. (sect. *Juncorchis*). From the summit Goh Lemboeh to bivouac Halfweg, 2500 m.
9157 — **Bulbophyllum** spec. From summit Goh Lemboeh to bivouac Halfweg, 2400 m.
9162 — **Bulbophyllum** spec. (sect. *Monilibulbus*). From summit Goh Lemboeh to bivouac Halfweg, 2200 m.
9163 — **Bulbophyllum** spec. (sect. *Aphanobulbon*). From the summit Goh Lemboeh to bivouac Halfweg, 3000—1850 m. Probably = *n. 8407* = *9753.*
9388 — ? **Microstylis** spec. From Gadjah to Blang Kedjeren, 1450 m.
9430 — **Aphyllorchis** spec. From Kongke to Paloh, 1100 m = *9814.*
9701 — **Liparis** (sect. *Rhachidibulbon*). Summit G. Kemiri to bivouac Aloer 3300—2850 m.
9746 — **Apostasia** spec. G. Kemiri, east side, from bivouac Aloer to bivouac 1, 1800 m.
9753 — **Bulbophyllum** spec. (sect. *Aphanobulbon*). G. Kemiri, east side, from bivouac Aloer to bivouac 1, 2000 m.

9814 — **Aphyllorchis** spec. From Kongke to Paloh, 1100 m = *9430*.

9865 — **Bulbophyllum** spec. (sect. *Aphanobulbon*). Sanger valley to bivouac 2, above Blang Kedjeren, 1050—1150 m.

9883 — **Dendrochilum** spec. (sect. *Eudendrochilum*). From Sanger bivouac 2 to bivouac 3 on the confluence of K. Kapi and K. Aoenan, 1100 m.

9941 — **Dendrochilum** spec. (sect. *Eudendrochilum*). From bioouac 3 on the confluence of K. Kapi and K. Aoenan to bivouac Paja, swamp Paja Kapi, 1100—1250 m.

9951 — **Thrixspermum** spec. (sect. *Orsidice*). From bivouac 3 on the confluence of K. Kapi to bivouac Paja, swamp Paja Kapi, 1100—1250 m.

9989 — **Calanthe** spec. (sect. *Eucalanthe*). From bivouac 3 on the confluence of K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m.

10012 — **Microsaccus** spec. From bivouac Paja (5) to bivouac Meer (6), 1250—1500 m.

10022 — **Vrydagzynea** ? n. sp. From bivouac Paja (5) to bivouac Meer (6), 1250—1500 m.

ON A NEW SPECIES OF PASPALUM FROM THE ISLAND OF BONAIRE

by

Dr J. TH. HENRARD
(Rijksherbarium, Leiden)

(Issued April 15th, 1943).

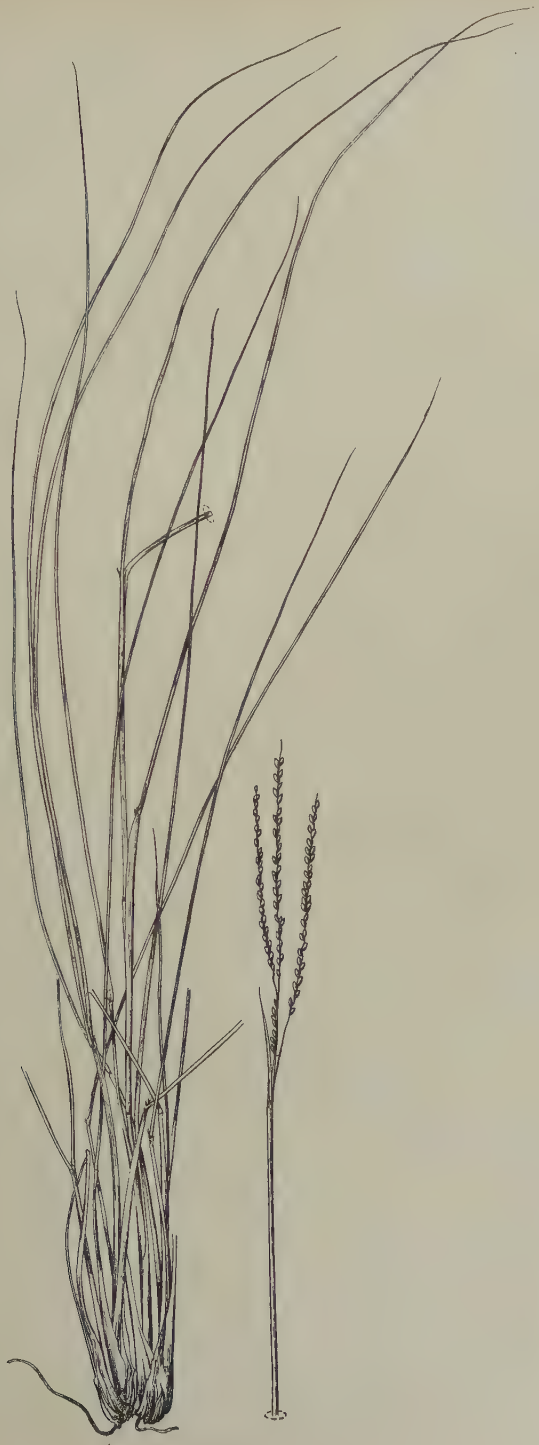
Among the plants collected in the West-Indies by I. Boldingh during the years 1909 and 1910 there was a grass determined as *Paspalum hemisphericum* Poir., a name changed into *glabrum*. These determinations are incorrect because *Paspalum hemisphericum* Poiret is the same as the well-known *Paspalum paniculatum* L. and also quite different from Poiret's *Paspalum glabrum,* which, according to Mrs. A. Chase's investigations, is the *Paspalum laxum* of Lamarck.

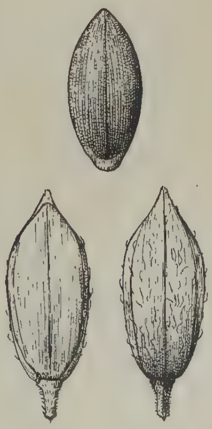
Among Bolding's plants there is a good specimen from the island of Bonaire, which, studied with Chase's work on the North-American species of *Paspalum,* could not be identified. In Chase's work also the species of Central-America and the West-Indian Islands are taken up, moreover the latter are also treated in Hitchcock's posthumous work on the grasses of that region.

To find relationships with one of the known species, we have at first to note some principal general characters of our new species. It is a perennial species with a not flabellate inflorescence, the racemes are solitary or many, but not conjugate at the summit of the culms, the rhachis is not winged and the spikelets are paired with a wanting first glume, but the second one is present. There are no truly axillary racemes.

We note further that the inflorescence consists of more than one raceme and that the outer scales of the spikelets are not crumpled. The plant is strictly caespitose and quite erect without decumbent base, the spikelets although slightly pubescent are not conspicuously ciliolate and the so-called fruit is light brown, but not shining. The plant is not very robust and less than 1 m high with relatively slender culms. Characteristic are the form and the outline of the spikelets, which are about 2½ mm long, elliptic to oval and somewhat abruptly narrowed upwards, the upper part triangular.

These characters, together with the very elongate and narrow, not more than 2 mm broad blades, would place the species in the group of the "*Alterniflora*", as this group is accepted by Chase. To only one of the species of this group the new species is more allied. If we try to find other relationships it becomes evident that our species which is





striking by its firm, folded, more or less involute-margined blades, a species growing in hard tufts, is most allied to a species from Cūba, the *Paspalum rocanum* Leon, which has the same habit but differs in the form of the glabrous spikelets. As to the chief characters of our species we can say that it is more allied to species which have a more southern distribution and it is, in my opinion, rather certain that *Paspalum rocanum* Leon does not belong to the "*Alterniflora*" as was proposed by Chase, who observed already that *Paspalum rocanum* was placed in the "*Alterniflora*" for convenience. This view I can wholly support. Our new species, together with the Cuban *P. rocanum* belongs to the South-American group of the "*Flaccida*" from Brazil and is especially allied to *Paspalum flaccidum* Nees and as to its habit also to *Paspalum filifolium* Nees. Comparing our species with these two ones, we note immediately the long filiform blades and the dense caespitose growth. Both Brazilian species differ, however, from the West-Indian one. *Paspalum flaccidum* has larger glabrous spikelets and a shorter second glume so that the fertile lemma is distinctly exposed, in our species the second glume is the longest one and pointed a little beyond the fruit. *Paspalum filifolium* Nees, although agreeing in habit, has two conjugate racemes at the summit of the culms and belongs to the South-American group of the "*Linearia*".

As to all the important characters treated here in extenso, we are satisfied that the plant we were studying is a distinct new species from Bonaire that it belongs to the group of the "*Flaccida*" and that it is somewhat allied to *Paspalum rocanum* Leon, which ought to be replaced in the same group of the "*Flaccida*", the group of the "*Alterniflora*" now being only represented by two species which are very characteristic on account of the form of their solitary spikelets and their geographical distribution, being only found in Cuba and Haïti. Both species of the group of the "*Alterniflora*" I could compare and also the *P. rocanum* from Cuba. This important material for comparison was formerly received from my late friend Hitchcock. We have now only to compare the data given by Hitchcock in his posthumous work: "Manual of the grasses of the West Indies". The genus *Paspalum* is treated there quite in the same way as is done by Chase in her monographical study and the long key gives us all the necessary characters for a quick identification. Following this key we arrive without difficulties at the relationship of *Paspalum rocanum, Paspalum Bakeri* Hack. and *Paspalum pleostachyum* Doell. The two latter ones belong to the group of the "*Caespitosa*". I could compare them, both have perfectly glabrous spikelets. We thus arrive with Hitchcock's work at quite the same conclusions.

The new species, which is figured here (p. 325) at slightly less than ½ natural size, the spikelets 10 times magnified, so as to compare them with figures in Chase's work, also magnified 10 times, is named here:

Paspalum bonairense Henr., nov. spec.

Dense caespitosa, culmi stricte erecti cum panicula paululum exserta, 50 cm vel paulo plus alti, a basi squamis aphyllis induti, subcompressi, laeves, nodis glabris nigricantibus; vaginae internodiis longiores inferne carinatae superne rotundatae valde hiantes, summae arctae glabrae, marginibus hyalinis praeditae, ligula fusca longe auriculatim producta, auri-

culae longe fimbriatae; laminae anguste lineares, convolutae sensim longe setaceo-acuminatae, vi expansae circ. 2 mm latae, 30 cm vel plus longae; inflorescentia paulo exserta, a basi vagina ultima circumdata, e racemis circ. 4 composita; racemi singuli, subremoti, rhachis triangularis, marginibus scabris, spiculae 2½ mm longae binae altera longe, altera breviter pedicellata, pedicellis scabro-puberulis, angulatis; spiculae ellipticae vel ovales, a basi sensim, superne distincte acuminatae, gluma prima deest, gluma secunda spiculam aequans, convexa, 3-nervis, nervo medio producto, nervis lateralibus evanescentibus, acuta, pilis sparsis pilosa, gluma III (lemma sterilis) nervo mediano indistincto praedita, plana, glabra, superne aequaliter rotundata, apice obtiuscula, spicula paulo brevior; gluma III (lemma fertilis) elliptico-ovalis, longitudinaliter punctato-striata.

Insula Bonaire, Plantae Indiae occid. ab *I. Boldingh* anno 1909—1910 collect. *N° 7370. Typus* speciei in Herb. Utrecht (No. 12305).

SOME CHLOROPHYCEAE FROM THE MARINE SALINES OF BONAIRE (NETHERLANDS WEST INDIES)

by

JOSÉPHINE TH. KOSTER
(Rijksherbarium, Leiden)

A collection of samples containing algae from the salines of Bonaire was brought home by Mr P. Wagenaar Hummelinck from his trips to the Netherlands West Indian Islands in 1930 and in 1936—1937. Though these trips were chiefly undertaken in order to gather zoological material (1, 2) [1], the collector paid attention to botanical objects as well, results of which are to be found in eight earlier papers (3—10).

Several data concerning Bonaire can be learned from Mr Wagenaar Hummelinck's publications. The island, having an area of about 265 km², is chiefly composed of quaternary limestone (coralrocks), which forms a large plateau in the North East and the South. The Northwestern part of the island is much higher and more indented. Klein Bonaire, having an area of only 7 km² and situated ¾ km West of Bonaire, consists of a low limestone plateau only.

A saline (saliña, salinja) may be a real saltlake or a plain, on which in the rainy time more or less briny water is to be found. The salines are usually separated from the sea by a porous wall of coral debris.

The algae have been preserved either dry, or in formaline or alcohol and are to be found in the Rijksherbarium at Leiden.

Bathophora Oerstedi J. Ag. in Öfvers. Kungl. Vet. Akad. Förh. 11, 1854, 107; Børgesen in Bot. Tidsskr. Bd. 23, 1900, 56; Howe in Bull. Torrey Bot. Club Vol. 32, 1905, 578; Børgesen in Bot. Tidsskr. København Bd. 28, 1908, 273, fig. 3; Børgesen in Biol. Arbeyder tilegnede Eug. Warming, 1911, 50; Børgesen, Mar. alg. Dan. W. Ind. Vol. I, 1913—1914, 73, fig. 58—60; Howe in Britton, Fl. of Bermuda, 1918, 499; Howe in Britton and Millspaugh, Bahama Fl., 1920, 604; Printz in Engl.-Prantl, Nat. Pfl. Fam. 2. Aufl. Bd. 3, 1927, 291, fig. 228, 229; Taylor in Pap. Tortugas Lab. Carn. Inst. Wash. Vol. XXV, 1928, 68, Pl. 5, fig. 1, 2, 15, 16; Fritsch, Struct. and Reprod. of the Algae, 1935, 389, fig. 123 E, G; Taylor in Carn. Inst. Wash. Publ. 461, 1935, 118; Taylor in Pap. Mich. Acad. Sci., Arts and Lett. Vol. XXI, 1935, 205; — *Dasycladus occidentalis* Harv. Ner. Bor. Amer., Part III, 1857, 38, Pl. 41 B, fig. 1—6; Cramer in Neue Denkschr. Allgem. Schweiz. Naturf. Gesellsch. Bd. 30, 1887, 37, T. V, fig. 2—8 (subgenus *Coccocladus*); — *Dasycladus Conquerantii* Crouan in Schramm et Mazé, Alg. de la Guadeloupe, 1866, 115; Mazé et Schramm, Alg. de la Guadeloupe, 2e ed., 1870—1877, 108; — *Botryophora occidentalis* J. Ag., Till Alg. Syst. V Afd., 1887, 141; Murray in Journ. of Bot. Vol. 27, 1889, 242; Børgesen in Bot. Tidsskr. Bd. 23, 1900, 56; Collins in Proceed. Amer. Acad. of Arts and Sci. Vol. 37, 1901, 247; Sluiter in Rec. Trav. Bot. Neerl. IV, 1907, 6; — *Coccocladus occidentalis laxus* Howe in Bull. Torrey Bot. Club Vol. 31, 1904, 95, Pl. 6, fig. 1, 2 — *Coccocladus occidentalis Conquerantii* (Crouan) Howe in Bull. Torrey Bot. Club Vol. 31, 1904, 96.¹)

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[1] The numbers in brackets refer to the bibliography.

Loc.: Salinja Plenchi, on shells of *Cerithium*, along the flat and low shore of a very shallow lake, which contains sea water; temp. ca 32—35° C; Cl ca 30—40 gr/l; 3 XII 1930. Two groups of club-shaped plants, among which one specimen with spherical sporangia (according to Fritsch gametangia, called aplanosporangia by Printz); plants 2½—6 cm long, 6—9 mm thick, of one group of plants the principal axis is covered with branches to the base, of the other it becomes branchless to the base. Of the specimens in the Leiden Herbarium this branchless basal part is quite variable in length varying from 0—8½ cm. There seems to be a relation between the age of the plant and the length of this branchless basal part, the branches dropping from the base to the apical part. Whorls of scars are to be seen on the branchless basal part.

Loc.: Salinja Plenchi, on crusts of lime and shells, in a very shallow pool; temp. ca 32—35° C; Cl. 42, 25 gr/l; 26 III 1937. Much aggregated, 2—2½ cm long, 3—7 mm thick, covered with branches almost to the base; sporangia spherical, crowded.

Loc.: Lac, to the West of the island Rancho, in a shallow muddy lagoon, about ¾ m deep, blocked from the open water by mangroves; temp. ca 32° C; Cl 20—25 gr/l; 8 X 1930. Lac is a bay on the East-coast, which is protected against the violence of the surf by a reef. A large beach forest of *Rhizophora* borders Lac (1, p. 304). Lax habit; most of the plants elongated, 2—11 cm long, 3—7 mm thick, basal part, ½—6½ cm long, without branches, whorls distanced; sporangia ovoid.

Loc.: Salinja Klein Bonaire, on crusts of lime, along the wall of debris bordering a shallow saltlake; much floating material in the water; temp. 32° C; Cl ca 39 gr/l; 9 VI 1930. Small poor plants, about 1 cm high.

The area of *Batophora Oerstedi* (fig. 1) is limited, but the species is locally frequent (acc. to the labels of the herbarium specimens and to literature). The area includes: the Bermuda Islands, Florida (Pinellas County, Tarpon springs, Miami, Cutler, Key West, Dry Tortugas), Bahama Islands (Great Bahama Island, Berry Islands, Rose Island, New Providence Island, Nassau Island, Andros Island, Cat Island, Great Exuma (Georgetown), Great Ragged Island, Watling's Island, Acklin Island, Mariguana Island, Caicos Island); Cuba, British Honduras (Belize),

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¹) As a consequence of the present war a great deal of the new literature of the last four years has been inaccessible to the author.

Jamaica (Kingston, Port Antonio), St Croix, Tortola, Guadeloupe (Pointe à Pitre), Bonaire (and Klein Bonaire), Curaçao.

Bathophora Oerstedi occurs in brackish or salt, quiet (sometimes dirty), shallow to 3 m deep water, between the tide marks or near the low water mark. The habitats mentioned include: pools, lagoons and creeks, mud (sometimes almost dry). sand, rocks, cays, coral fragments, crusts of limestone, shells, pebbles, sticks, old shoes, algae (*Halimeda*, *Sargassum*), rhizomes of *Thalassia*, and roots of *Rhizophora* and *Avicennia*.

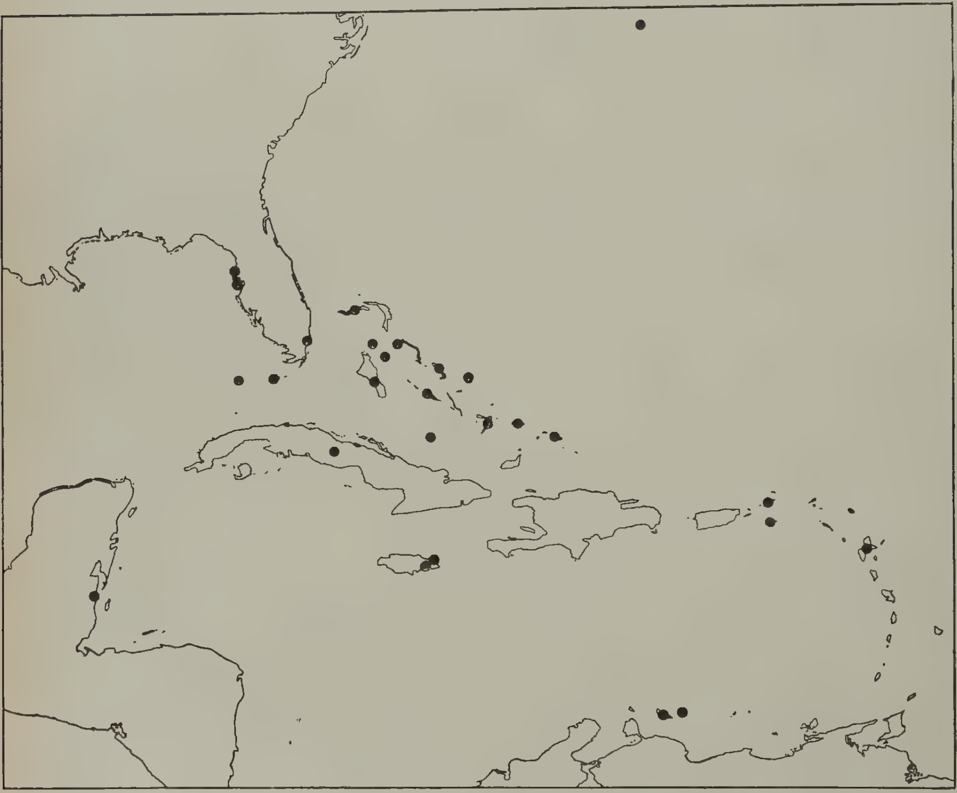

Fig. 1 — Area of *Batophora Oerstedi* J. Ag.
Where no exact locality is known to the author, the dot is placed in the centre of the island concerned.

Howe concludes that the salinity and the quietness of the water influence the size and habit of the plant and the shape of the sporangia. In quiet and often brackish water the habit is lax and large, the sporangia are obovoid or oblong (var. *laxus* Howe, considered by himself unworthy to be kept up as a variety); along the border of the open ocean the habit is condensed (var. *occidentalis* [Harv.] Howe, kept up by Taylor). Howe studied living plants and found intermediate habits in places of intermediate character. Børgesen, after having inspected the species in St Croix, quite agreed with him.

The specimens in the Leiden Herbarium are 1—14 cm long and 2—12 mm thick on the greatest width. Geographically distinguished they have the following dimensions.

Usually robust are the plants from the Bahamas:

cm long	mm thick	sporangia	habitat
1½—2½	3—4		
5—7	5—6	spherical	low littoral to 2 m
5—10	5—6	ovoid	salt water
10—14	6—12	spherical or ovoid	slightly brackish pond

The plants from the Bermudas are small:

cm long	mm thick
2—2½	3
2½—3½	2—3

and very small those from Key West:

1—1½ cm long, 2 mm thick.

and from Jamaica:

1 cm long, 2 mm thick.

The specimens from the peninsular part of Florida are moderate in size:

cm long	mm thick	sporangia
± 4	3	spherical
3½—6½	4—5	

but from the Antilles we find all sizes:

St Croix:	cm long	mm thick	sporangia
	2—5½	5—9	ovoid
	2½—6	5—6	spherical or ovoid

Tortola: 1½—2½ cm long, 2—3 mm thick.

Bonaire:	cm long	mm thick	sporangia	habitat, Cl gr/l
	± 1	5		39
	2—2½	3—7	spherical	42, 25
	2½—6	6—9	spherical	30—40
	2—11	3—7	ovoid	20—25

The data of the plants from Bonaire give some indications to Howe's conclusion: the higher the salinity of the habitat, the smaller the plant and the more spherical the sporangia.

Enteromorpha flexuosa (Wulf.) J. Ag., Till Alg. Syst. III Afd., 1883, 126; Collins in Proceed. Amer. Acad. Arts and Sci. Vol. 37, 1901, 242; Collins in Rhodora V, 1903, 21, Pl. 42, fig. 3; Vickers, Phycol. Barbad., 1908, 15, Pl. III, fig. 1—9; Børgesen, Mar. Alg. Dan. W. Ind. I, 1913—1914, 5; Weber—van Bosse, Liste des Alg. du Siboga, 1913—1928, 52; Howe in Britton, Fl. of Bermuda, 1918, 494; Setchell and Gardner in Univ. Calif. Publ. Bot., Vol. VIII, 1919—1920, 255; Howe in Britton and Millspaugh, Bahama Fl., 1920, 598; Taylor in Pap. Tortugas Lab. Carn. Inst. Wash., Vol. XXV, 1928, 55, Pl. 7, fig. 2; Taylor and Arndt in Amer. Journ. of Bot. XVI, 1929, 655; Lakowitz, Algenfl. Ostsee, 1929, 121, fig. 167; Feldmann in Bull. Soc. Hist. Nat. Afr. du Nord, T. 22, 1931, 202; Børgesen in Kgl. Danske Vidensk. Selsk., Biol. Medd. XII, 2, 1935, 8; Feldmann in Rev. Alg. T. IX, 1937, 52; Børgesen in Kgl. Danske Vidensk. Selsk. Biol. Medd. XV, 4, 1940, 9 — *Enteromorpha compressa* (L.) Grev. var. *flexuosa* (Wulf.) Hamel in Rev. Algol., T. VI, 1931, 63, fig. 48, 1—2.

Loc.: Lagoen di Goto, near Riscado, on debris, in a porous place of the shore of a large saltlake; temp. ca 30° C; Cl ca 20—30 gr/l?; 26 VIII 1930. Tubular, tubes attached, many together, aggregated, gradually attenuate to the base to filiform, sometimes undulate and somewhat shrivelled, unbranched, (except for some few very short branches at the base), to 6 cm long, ¼—5 mm wide; cells in regular longitudinal rows, mostly square or rectangular, sometimes triangular, often with rounded angles, 12—20 μ long and broad.

Loc.: Lagoen di Goto, Eastshore, on coral debris, in porous places of the steep shore of a large saltlake and near the wall of debris; salinity locally variable; temp. ca 30° C; Cl ca 25—35 gr/l; 26 VIII 1930. Tubes about ½ mm wide, consisting of about 2—30 longitudinal rows of cells; cells rectangular or polygonal, 20—32 μ long, 16—20 μ broad.

Loc.: Salinja Foenshi, on debris, along the porous wall of debris of a saltlake; temp. ca 30° C; Cl ca 25—30 gr/l; 9 IX 1930. Tubes flexuous, often more or less crispate, unbranched, to 12 cm long, ½—2 mm wide; cells in fairly regular longitudinal rows, subrectangular, 12—16 μ long and broad.

Loc.: Salinja Foenshi, on rocks, a few decimetres above the water-level, dry, indicating a higher water-level in the rainy season; temp. 30° C; Cl ca 30—40 gr/l; 9 IX 1930. Tubes narrow, to ½ mm broad; cells subrectangular, 8—16 μ long and broad.

This marine species occurs in the West Indies in: the Bahamas, Jamaica, Haiti, St Croix, St Jan, Barbados; further it is recorded from Florida, the Bermudas, from the Mediterranean, the Baltic, the Atlantic coast of France, Algeria and from Mauritius, Bombay and the Malay Archipelago. Feldmann supposes the species to be cosmopolitan, especially in the warmer seas. It grows on stones, rocks, shells, algae, in pools, in the littoral zone, in sheltered places, in stagnant water, as well as in places exposed to the surf, often in brackish water.

Cladophora delicatula Mont. in Ann. Sci. Nat. Sér. 3 Bot., T. XIV, 1850, 302; Kütz, Tab. Phyc. VI, 1856, 1, T. 1, fig. II; Mazé et Schramm, Alg. de la Guadeloupe, 2e ed., 1870—1877, 65; Murray in Journ. of Bot., Vol. 27, 1889, 259; Collins, Green Alg. N. Am., 1909, 337; Setch. et Gardner in Univ. Calif. Publ. Bot., Vol. VIII, 1919—1920, 220; Taylor in Pap. Tortugas Lab. Carn. Inst. Wash., Vol. XXV, 1928, 61; (fig. 2).

Loc.: Lagoen di Goto, near Riscado, on debris, in a porous place of the shore of a large saltlake; temp. ca 30° C; Cl ca 20—30 gr/l ?; 26 VIII 1930. Filaments very thin, about 40 μ thick; ramifications of the first order elongated, subdichotomous, especially to be found at the superior part of the plant; of the

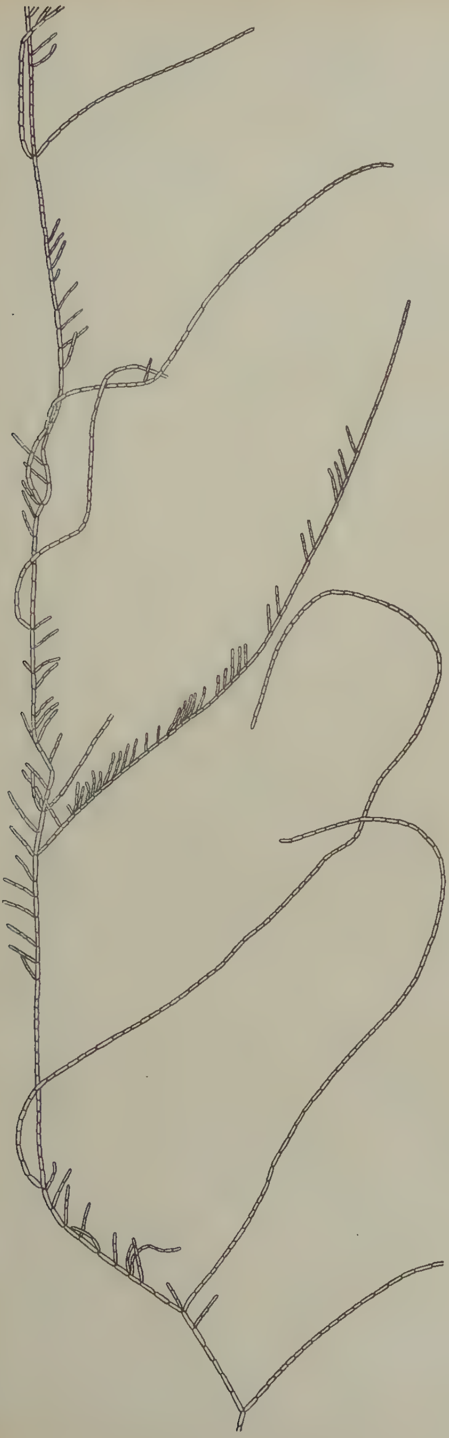

Fig. 2 — *Cladophora delicatula* Mont., × 25.

second order short, comblike, fairly close together, often more or less unilateral, but not quite in the same plane above each other, lacking on many ramifications of the first order, obtuse at the tip, usually existing of 3—4 cells; cells 2—6 times as long as broad, gradually shorter to the tip.

Agrees well with the specimen in Kützing's Herbarium, to which a label is added, on which Montagne has written "Cladophora delicatula Montg. — Guyana — hb Montagne". This specimen must be part of the type and has been used by Kützing for the figure in Tab. Phyc.; it is still less branched than the specimens of Bonaire. More branched on the contrary are two specimens from California (Phyc. Bor. Am. 1582) and Bermuda (Phyc. Bor. Am. 2070) and of these the filaments are thicker, about 80 μ thick. They may belong to a variety or to a different species. The area of this *Cladophora* species includes with certainty only Cayenne (on rocks along the sea, exposed to the surf) and Bonaire, but Collins records also California, Florida, Jamaica and Puerto-Rico (however, his description does not quite agree with the specimen mentioned above).

Loc.: Lagoen di Goto, Eastshore, on coral debris, in porous places of the steep shore of a large saltlake and near the wall of debris; salinity locally variable; temp. ca 30° C; Cl ca 25—35 gr/l; 26 VIII 1930. Not numerous.

Some few more species of *Chlorophyceae* (*Chaetomorpha*, *Cladophora*) were only extant in too fragmentary specimens to secure a correct identification.

Frémy, whose paper (10) has reached the author only after her manuscript was completed, records the following species of *Chlorophyceae* from the salines of Bonaire: *Bathophora Oerstedi* (Salinja Klein Bonaire, 9 VI 1930), *Enteromorpha flexuosa* Ag. (Goto, Lagoen, 26 VIII 1930; Salinja Foenshi, 9 IX 1930), *Enteromorpha intestinalis* (Salinja Paloe Lechi, 28 VIII 1930), *Enteromorpha prolifera* (Goto, Lagoen, 26 VIII 1930), *Chaetomorpha Linum* (Salinja Paloe Lechi, 28 VIII 1930), *Rhizoclonium Kochianum* (Salinja Paloe Lechi, 29 VIII 1932 [not 1930, J. Th. K.]; Goto, Lagoen, 26 VIII 1930), *Cladophora expansa* (Salinja Paloe Lechi, 28 VIII 1930), *Cladophora fracta* (Salinja Slagbaai, 8 IX 1930).

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NOTE ON POUTERIA
(SAPOTACEAE)

by

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(Issued April 15th, 1943).

In recent years Baehni has provided us with some elaborate studies on the Sapotaceae (1, 2) and we understand that it is his intention to continue the series of generic monographs.

As I pointed out in a criticism (8) concerning the first of his papers, this seemed not a very successful beginning, be it only because one usually does not start a series of generic monographs by giving a survey of the whole family with the nature of a conclusion, without risking the judgment of prematurity. As might have been expected this paper contains a number of incorrectnesses, which may largely be ascribed to an insufficient knowledge of this intricate and difficult family.

Now, the most recent of Baehni's papers deals with the large genus *Pouteria* (2), in Baehni's sense doubtless the largest genus of the family and in many respects the one with the largest number of primitive characters. In this elaboration the author has combined a large number of previously independent genera.

Every systematist knows that, if ever, in taxonomical work the rule holds true that the proof of the pudding is in the eating. Only a repeated and intensive, critical and practical use of a monographical elaboration of a group of plants can provide us with sufficient arguments to decide whether the work is reliable or not. And, not being familiar with the greater part of the *Pouteria* species, namely with those from America and from Africa, I will, for the time being, refrain from giving such critical remarks as present themselves even at a cursory glance through the work in question, restricting myself to the following points:

1. The scientific responsibility of a monographer is very great — being proportional with the difficulty and the size of the group of organisms concerned —, as another investigator is not likely to attempt a second revision of the same group, however unsatisfactory the monograph may be, as long as other important groups of the same family are left waiting;

2. It is may personal experience that the system of the Sapotaceae I am familiar with (Asiatic and Polynesian), only clearly shows its particular structure by a procedure of moderate generic splitting: e. g. the Malaysian *Madhuceae* only became understandable after Pierre unraveled

them by splitting them up into four smaller genera with seemingly insignificant, yet very distinct morphological and geographical differences. Similar conditions are paramount in the *Mimusopoideae.* This does, of course, not imply that the same is necessarily true regarding the other groups of the family but it may serve as an admonition to use the utmost care and scrutiny in their elaboration;

3. In my opinion every systematist is morally obliged (as well as *nolens volens* scientifically compelled) to follow the monographer as long as the incorrectness of his statements is not proved.

I want to repeat emphatically that these remarks do not particularly allude to Baehni's monograph although they were, of course, inspired by it. Therefore, in spite of a certain hesitation, based upon the unsatisfactory nature of his previous work, and in spite of the fact that Baehni's subdivision of *Pouteria* ominously reminds us of Engler's elaborate but not lasting subdivision of *Sideroxylon* (3, p. 143), I am, in accordance with the above-mentioned point 3, provisionally prepared to accept his conclusions.

The above might have remained unwritten until a later date, if I had not presented to the Editor of "Boissiera", to be published in the volume in honour of Prof. B. P. G. Hochreutiner of Geneva, a small paper, containing the description of three new *Planchonella* species (9). After the MS. of this paper had been despatched, Baehni's monograph was issued, in which *Planchonella* is combined with *Pouteria.* A corrected version of my paper was, unfortunately, received too late to be inserted in the "Boissiera" volume mentioned.

I will, therefore, rename my three new species here and avail myself of the opportunity to add a few remarks of an additional nature.

1. **Pouteria** (§ *Oligotheca* A. DC.) **Hochreutineri** (H. J. Lam) H. J. Lam, nov. comb. — *Planchonella Hochreutineri* H. J. Lam, Boissiera VII, 1943, 92, fig. 5 — New Guinea (*Carr 13023, type: Id. 15404*).

2. **Pouteria** (§ *Oligotheca* A. DC.) **sarcospermoides** (H. J. Lam) H. J. Lam, nov. comb. — *Planchonella sarcospermoides* H. J. Lam, l. c. 94, fig. 5 — New Guinea (*Carr 12933, type*).

3. **Pouteria** (§ *Oligotheca* A. DC.) **Clementis** (H. J. Lam) H. J. Lam, nov. comb. — *Planchonella Clementis* H. J. Lam, l. c. 97, fig. 6 — New Guinea (*Clemens 1155, type*).

4. **Pouteria** (§ ?) **monticola** (Krause) H. J. Lam, nov. comb. — *Sideroxylon monticolum* Krause, Engl. Bot. Jahrb. 58, 1923, 481 — *Planchonella monticola* (Krause) H. J. Lam, Nova Guinea XIV, Bot., Livr. 4, 1932, 561, Tab. CXII — New Guinea.

This species was apparently overlooked by Baehni and not mentioned in his monograph.

5. "*Racemose*" *inflorescences.* In the discussion accompanying the description of *Planchonella sarcospermoides* the inflorescences of this and some other species were called racemose. The same term is repeatedly used in Baehni's monograph ("véritables racèmes", l. c., p. 157 and he even bases partial subdivisions upon it (l. c., pp. 194, 198, 219, 269, 283). However, this interpretation is, I think, not correct. The fundamental arrangement of the flowers in the Sapotaceae is fasciculate. This is, of

course, morphologically speaking, a racemose inflorescence, and the fascicle (Baehni prefers the term "umbels") might be considered a contracted raceme. In those cases in the Sapotaceae, however, in which the axis of the inflorescence is elongated, the arrangement is never, as far as I am aware, genuinely racemose; there is always some trace of fascicles. It seems, therefore, that this condition of pseudo-racemose inflorescences is not on the primitive side of the alleged evolutionary process of these inflorescences (the contraction from true racemes into fascicles), but rather represents an advanced phase. Within the Sapotaceae the following examples may then illustrate the trend of the supposed evolution of this organ (according to Baehni these pseudo-racemose inflorescences are particularly frequent in New World species):

a. *Pouteria duclitan* (Blanco) Baehni (formerly *Planchonella nitida* Dub.) from Malaysia: fascicles many-florous, often along leafless shoots, however, with many transitions into the normal sapotaceous type (axillary fascicles; 4, tab. 607). The same condition, although less pronounced, is sometimes also found in some other species such as *P. kaniensis* (Krause) Baehni (6, tab. 124) and very rarely in *P. firma* (Miq.) Baehni. The last-named fact shows that the systematic place given to this species in Baehni's monograph, is unnatural.

b. *Pouteria pedunculata* (Hemsl.) Baehni from China: short axillary pseudo-racemes with 1- to 3-florous fascicles (10, p. 259, fig. 3).

c. *Pouteria sarcospermoides* H. J. Lam from New Guinea: almost the same condition as mentioned sub b, only the fascicles more crowded (9, p. 93, fig. 5).

d. *Aulandra* (*Madhucoideae-Palaquieae*), 2 species from Borneo: cauliflorous, racemes divaricate, densely covered with flowers; the fascicles are probably all 1-florous (5, p. 416, fig. 6; and 7, tab. 3360).

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THE CONVOLVULACEAE OF MALAYSIA, IV ¹)

(with Indices)

by

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(Issued April 15th, 1943).

The genera Mina, Lepistemon, Stictocardia and Argyreia.

The genera *Mina* and *Lepistemon* belong to the *Ipomoeeae* Hall. f., *Stictocardia* and *Argyreia* to the *Argyreieae* Hall. f.

XVII. MINA Cerv.

Cerv. in De la Llave & Lex., Nov. Veg. Desc. fasc. I (1824) p. 11; Choisy in DC., Prodr. IX (1845) p. 337; Peter in Engl. & Prantl, Nat. Pfl. fam. IV, 3a (1891) p. 25 — *Ipomoea* L. subgenus *Quamoclit* (Moench) Meissn. section *Mina* (Cerv.) Meissn. in Mart., Fl. Bras. VII (1869) p. 220 — *Quamoclit* Moench section *Mina* (Cerv.) House in Bull. Torr. Bot. Club XXXVI (1909) p. 596.

Herbaceous twiners. Leaves entire or mostly palmately lobed. Flowers in axillary, pedunculate, few- to several-flowered cincinni or double cincinni, often secund; bracts minute; pedicels short. Sepals 5, herbaceous, subequal, distinctly awned, not enlarged in fruit. Corolla suddenly widened above a short narrow tubular base, the limb long-urceolate to tubular, subangular, slightly curved, with slightly constricted 5-toothed mouth. Stamens and style long exserted. Filaments inserted at the top of the narrow basal tubular part of the corolla. Pollen globular, spinulose. Disk annular. Ovary glabrous, 4-celled, each cell with 1 ovule; stigmas 2, capitate. Fruit a 4-valved, 4-celled capsule, with 4 or less, glabrous seeds.

Only one cultivated species in Malaysia:

Mina lobata Cerv. in De la Llave & Lex., Nov. Veg. Desc. fasc. I (1824) p. 12; Lindl. in Bot. Reg. XXVIII (1842) Misc. p. 5 and t. 24; Choisy in DC., Prodr. IX (1845) p. 337; Hook. in Curtis, Bot. Mag. CXXV (1899) t. 7689 — *Quamoclit Mina* G. Don, Gen. Syst. IV (1838) p. 259; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 131 — *Ipomoea versicolor* Meissn. in Mart., Fl. Bras. VII (1869) p. 220 — *Mina cordata* Micheli in Rev. Hort. (1898) p. 554; id. (1899) p. 308 — *Quamoclit lobata*

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¹) Part I in Blumea III, 1 (1938) p. 62—94; part II in Blumea III, 2 (1939) p. 267—371; part III in Blumea III, 3 (1940) p. 481—582.

(Cerv.) House in Bull. Torr. Bot. Club XXXVI (1909) p. 602; Bruggeman, Ind. Tuinboek (1938) p. 65 — *Ipomoea lobata* (Cerv.) Thell. in Vierteljahrsschr. Nat. Ges. Zürich LXIV (1919) p. 775.

A glabrous, perennial twiner with slender, terete, 2—5 m long stems. Leaves petiolate; petiole 3—10 cm long; blade broadly ovate in outline, cordate at the base, 6—15 cm long and broad, bright green above, paler beneath, entire or mostly deeply 3-lobed, the lobes acuminate, the middle lobe constricted below, the lateral lobes with some coarse teeth or often again lobed. Inflorescences up to 35 cm long (peduncle included); flowers in single or double cincinnal cymes, secund; pedicels 4—8 mm long; bracts minute. Sepals oblong, 5—6 mm long, the distinct, 2—3 mm long awn included. Corolla at first red, afterwards pale yellow or whitish, the narrow basal part 5—8 mm long, the slightly curved widened limb 17—20 mm long, the teeth mucronulate. Stamens and style declinate against the upper side of the limb, finally twice as long as the corolla; stamens pubescent towards the base; disk shallowly 5-lobed; ovary and style glabrous; stigmas papillose. Capsule broadly ovoid, 6—8 mm long.

Distribution: From Mexico to Central and South America, cultivated in other tropical and temperate regions as an ornamental plant.

Cultivated specimens:

JAVA, Buitenzorg, Buitenzorg, *van Harreveld s.n.*, fl. Sept. 1907 (L); Malang, Pasoeroean, *Backer 36306* (L).

XVIII. LEPISTEMON Blume

Blume, Bijdr. (1825) p. 722; Choisy in Mém. Soc. Phys. Genève VI (1833) p. 443; id. in DC., Prodr. IX (1845) p. 347; Miq., Fl. Ned. Ind. II (1857) p. 629; Benth. & Hook., Gen. Plant. II (1876) p. 873; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 216; Baill., Hist. Pl. X (1891) p. 322; Peter in Engl. & Prantl, Nat. Pfl. fam. IV, 3a (1891) p. 25; Hall. f. in Engl., Bot. Jahrb. XVI (1893) p. 583; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 503, 510; Baker & Rendle in This.-Dyer, Fl. Trop. Afr. IV, 2 (1905) p. 115; Prain in Journ. As. Soc. Bengal LXXIV (1906) p. 309; Koorders, Exk. fl. Java III (1912) p. 115; Gagnep. & Courch. in Lec., Fl. Indo-Chine IV (1915) p. 287; Ridley, Fl. Malay Penins. II (1923) p. 462; Merrill, Enum. Philipp. Fl. Pl. III (1923) p. 364; Backer, Onkruidfl. Jav. Suikerrietgr. (1931) p. 521 — *Lepidostemon* Hassk., Cat. Hort. Bog. alt. (1844) p. 140 — *Nemodon* Griff., Notul. IV (1854) p. 286 — *Ipomoea* L. series *Urceolatae* Benth., Fl. Austr. IV (1869) p. 427.

Herbaceous or woody twiners. Leaves herbaceous, ovate to orbicular, cordate at the base, entire or lobed. Flowers in dense, axillary, sessile or shortly pedunculate cymes; bracts small, deciduous. Sepals 5, subequal, herbaceous or subcoriaceous, hairy or glabrous, acute or obtuse. Corolla rather small, regular, urceolate, with a shortly 5-lobed limb. Stamens and style included. Filaments inserted near the corolla base, dilated at their base into a large concave scale, arched over the ovary. Pollen globular, spinulose. Disk large, annular or cupular. Ovary glabrous or hairy, 2-celled, each cell with 2 ovules. Style 1, very short. Stigmas 2, capitate. Fruit a 4-valved capsule with 4 or less glabrous or puberulous seeds.

Key to the species.

1a. Sepals ovate to broadly lanceolate, acuminate or acute, 5—7.5 mm long, herbaceous . . . . **1. L. binectariferum**

b. Sepals ovate to orbicular, obtuse or emarginate, 2—2.5 mm long, margin membranaceous . . . . **2. L. urceolatum**

1. Lepistemon binectariferum (Wall.) O. K., Rev. Gen. (1891) p. 446; Hall. f. in Meded. 's Lands Plantent. XIX (1898) p. 544; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 510; Koorders, Exk. fl. Java III (1912) p. 116; Koorders-Schum., Syst. Verz. (1910—13), Conv. p. 3; id. (1914) p. 110 — *Convolvulus binectariferus* Wall. in Roxb., Fl. Ind., ed. Carey & Wall. II (1824) p. 47 — *Lepistemon flavescens* Blume, Bijdr. (1825) p. 722; Choisy in Mém. Soc. Phys. Genève VI (1833) p. 444; id. in DC., Prodr. IX (1845) p. 348; Wight, Ic. IV (1850) t. 1362; Zoll., Syst. Verz., 2. Heft (1854) p. 128; Miq., Fl. Ned. Ind. II (1857) p. 629; Prain in Journ. As. Soc. Bengal LXIII (1894) p. 111; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 128; id. in Bull. Herb. Boiss. V (1897) p. 382; id. in Engl., Bot. Jahrb. XXVIII (1899) p. 30; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 510; Prain in Journ. As. Soc. Bengal LXXIV (1906) p. 309; Koorders, Exk. fl. Java III (1912) p. 116; Koorders-Schum., Syst. Verz. (1910—13), Conv. p. 4; Hall. f. in Engl., Bot. Jahrb. XLIX (1913) p. 380; Rendle in Journ. Linn. Soc. XLII (1914) p. 112; Gagnep. & Courch. in Lec., Fl. Indo-Chine IV (1915) p. 287, fig. 30; Bold., Zakfl. Java (1916) n. 829; Ridley, Fl. Malay Penins. II (1923) p. 462; Henderson in Gardens' Bull. Str. Settlem. IV (1928) p. 293; Backer, Onkruidfl. Jav. Suikerrietgr. (1931) p. 521 — *Vallaris controversa* Spr., Syst. Curae post. (1827) p. 65 — *Convolvulus cephalanthus* Wall., Cat. (1828) n. 1402, nomen — *Lepistemon Wallichii* Choisy in Mém. Soc. Phys. Genève VI (1833) p. 443; id. in DC., Prodr. IX (1845) p. 348; Miq., Fl. Ned. Ind. II (1857) p. 629; Clarke in Hook., Fl. Brit. India IV (1883) p. 216 — *Convolvulus flavescens* D. Dietr., Syn. Pl. I (1839) p. 680 — *Ipomoea flavescens* Steud., Nomencl., ed. 2, I (1841) p. 816 — *I. Wallichii* Steud., l. c. p. 820 — *Convolvulus ampullaceus* Vahl ex Choisy in DC., Prodr. l. c. p. 348 — *Nemodon spec.* Griff., Notul. IV (1854) p. 286.

A herbaceous twiner. Stems terete or angular, 1—3 m high (*Backer*), 1.5—3.5 mm thick, densely covered with patent or retrorse brown hairs. Leaves petiolate, petiole hairy like the stem, 2.5—16 cm long; blade broadly ovate, acuminate and mucronulate at the apex, deeply cordate at the base, 5—18 cm long, 5—15 cm broad, on both sides with appressed hairs, the young leaves, occasionally also the adult ones tomentose with a golden-brown tomentum, paler beneath than above, the margin entire or irregularly dentate with some large teeth or shallowly to deeply 3—5-lobed, the lobes acute or acuminate. Flowers in few- to many-flowered, dense, axillary, cymose clusters, which are much shorter than the petioles; common peduncle short or almost absent, at most 3 cm long; bracts small, deciduous; pedicels up to 7 mm long, glabrous or sparsely pilose. Sepals subequal or the inner ones a little shorter, broadly lanceolate to ovate, acuminate or acute, herbaceous, 5—7.5 mm long, with long patent hairs outside, glabrous inside, in fruit slightly or not enlarged. Corolla white or yellowish white, 12—15 mm long, urceolate, the tube inflated, contracted above, the limb patent with 5 very short lobes, the tube glabrous outside in the lower portion, shortly hairy above and on the midpetaline bands of the limb, glabrous inside. Scales at the base of the filaments concave, papillose, reddish (*Backer*). Style about as long as the scales, glabrous; stigma biglobular, papillose. Disk about as high as the ovary, with 5-lobed margin. Ovary globose, glabrous, 2-celled. Capsule globose to ovoid, mucronate by the remaining base of the style, glabrous, 6—8 mm high, with 4 or less seeds. Seeds black, glabrous, 3—4 mm long.

MALAY PENINSULA; according to Ridley in "thickets on borders of forests". Kelantan, riverside, *Md. Haniff & Nur, Singapore Field n. 10056*, fl. Jan. 1923 (B). Further known from Prov. Wellesley, Perak, Negri Sembilan and Selangor (Prain, Ridley, Henderson).

SUMATRA, without exact locality, *Korthals s.n., 93* and *109* (L); id., West Sumatra, *collector unknown n. 31,* fl. June 1909 (L); Atjeh and Dependencies, P. Weh, Sabang, S.W. of Anak laoet, *van Steenis 5725*, fl. Dec. 1933 (B); East Coast, without exact locality, *Yates 1246* (B); Sibolangit, *Lörzing 4113*, fl. Nov. 1915 (B); Tapanoeli, island Nias, *von Römer s.n.* (B); West Coast, W. slope of Talakmau, *Bünnemeyer 314*, fl. Apr. 1917 (B, L); Anai-kloof, *Kleinhoonte 590*, fl. and fr. Aug. 1932 (B); Ajer mantjoer, *Beccari 665*, fl. Aug. 1878 (L); Soengei Akar, Kerintji, *Bünnemeyer 8100*, fl. Febr. 1920 (B, L); Benkoelen, Kepalirang, *de Voogd 1105*, fl. May 1931 (B).

JAVA, without exact locality, *Blume s.n.* (L, U); *Horsfield s.n.* (L, U);. *Korthals 227* (L); *Kuhl & van Hasselt 73* (L); *Zollinger 120* (L); Bantam, G. Kentjana, *Koorders 41424* β, fl. June 1912 (B); id., *Koorders 41375* β, fl. and fr. June 1912 (B); G. Karang, *Koorders 40725* β, fl. June 1912 (B); id., near Galoesoer, *Koorders 40682* β, fr. May 1912 (B, L); id., near id., *Koorders 40724* β, fl. June 1912 (B); Sadjira, *Backer 2131,* fl. June 1911 (B); between Tjitorek and Moentjang, *Backer 1860*, fr. June 1911 (B); between Tjilèlès and G. Kentjana, *Backer 1203*, fl. June 1911 (B); Rangkas bitoeng, *Backer 1093*, fl. June 1911 (B); Batavia, Batavia, Pal Merah, *Backer 34437*, fl. July 1904 (B); grassfields near battery Moeara Angke, *Backer 34440*, fl. June 1903 (B); Meester Cornelis, *Backer 34439*, fl. July 1903 (B); id., *Backer 34438*, fl. Aug. 1903 (B); Wanajasa, *Backer 14357*, fl. June 1914 (B); Pasir Limoes, Boerangrang, *Bakhuizen van den Brink 4349*, fl. July 1920 (B, L); Tjihandjawar, above Wanajasa, S. of Poerwakarta, *Bakhuizen van den Brink 4313*, fl. July 1920 (B, L); Nangarang, near Wanajasa, *Bakhuizen van den Brink 4278*, fl. July 1920 (B); G. Parang, *Blume 1234*, fl. July (L, *type* of *Lepistemon flavescens* Bl.); id., *Backer 13940*, fl. June 1914 (B); estate Tjikoempai, E. of Poerwakarta, *Harmsen 94*, fl. Dec. 1921 (B); Buitenzorg, Depok, *Koorders 43988* β, fl. June 1917 (B, L); id., nature reserve, *Beumée 6068*, fl. Aug. (B); Tji Lodong, S.E. of Depok, *Backer, van Overeem & van Slooten 35159*, st. May 1922 (B); Buitenzorg, *Smith s.n.*, fl. July 1909 (B); id., *Reinwardt s.n.* (L); between Waroeng-mangga and Baranan-siang, *Hallier 210a,* fl. May 1893 (B); forest along Tjiliwoeng, near Botanic Gardens, *Hallier 210b*, st. Apr. 1893 (B); bank of Tjidani, above Bandongan, *Hallier 210c*, st. Apr. 1893 (B); Tjiogrek, *Backer 34436*, fl. June 1910 (B); Batoe toelis, *Lam & Went, herb. van Steenis 1553,* fl. May 1928 (B); id., *Hallier s.n.*, st. Nov. 1894 (B); along rivulet between Babakan and Kampong baroe, *Hallier s.n.*, st. Nov. 1894 (B); between Kampong baroe and Tanah sereal, *Hallier s.n.*, fl. and fr. June 1896 (B); Soekamantri, *Raap 116*, fl. May 1894 (L); Kabandoengan, *Soegandiredja 197*, fl. Apr. 1900 (B); G. Salak, above Pasir Pogor, *Backer 22187*, fl. May 1917 (B); Palaboehan Ratoe, *Boerlage s.n.*, fl. and fr. July (L); Soekaboemi, *Backer 14866*, fl. July 1914 (B); Kiara Pajoeng, N. of Tjiandjoer, *Zwaardemaker 33*, fl. Apr. 1918 (B); Tjiapoes, *collector unknown, s.n.* fl. June 1911 (B); Tjidadap, Tjibèbèr, *Bakhuizen van den Brink 2042,* fl. (B); Tjiandjoer, *Backer 3039,* fl. Sept. 1911 (B); Buitenzorg or Priangan, without exact locality, *Ploem s.n.* (L); "Bodjong Terong", *Aarts 17*, st. (B); Priangan, Soekaradja near Tasikmalaja, *Backer 8476*, fr. Aug. 1913 (B); Pekalongan, Soebah, *Beumée 4252*, fl. July 1919 (B, Wag); Banjoemas, Noesa Kambangan, *Backer 4633*, fl. Sept. 1912 (B); Limoes boentoe, *Amdjah 128,* fl. June 1909 (B); Pringambo, Bandjarnegara, *Koorders 34039* β, st. Aug. 1900 (B); Magelang, Wonosobo, *Brinkman 302*, fl. June 1930 (B); Semarang, Salatiga, Kali Taman, *Docters van Leeuwen s.n.*, fl. June 1909 (B); G. Oengaran, *Docters van Leeuwen s.n.*, fl. June 1914 (B); Telomojo, *Koorders 27706* β, fl. June 1897 (B); Madioen, between Toelahan and Tegalombo, river bank, *Backer 2923*, fl. Apr. 1912 (B); Ngebel, *Koorders 23169* β, fl. May 1896 (B, L); id., *Rant s.n.* (B); Kediri, Gadoengan, *Koorders 22874* β, fl. and fr. June 1896 (B, L); id., *Koorders 22967* β, fl. May 1896 (B); Malang, between Bantoer (S. of Gondang legi) and Prigontjo, *Backer 3974*, fl. June 1912 (B); Wonokerto, Gondang legi, *Koens s.n.*, fl. May 1912 (B); Poedjon, *Ultée 71*, fl. March 1929 (B); estate Kali Padang and Pantjoersari, *Experimental station Malang s.n.*, young fl. June 1936 (B); between "Smeroehoeve" and Sendoera, *van Steenis 7346*, fl. June 1935 (B); Zuidergebergte, Tangkil, *Koorders 23999* β, fl. June 1896 (B); Ranoe Daroengan, *Backer 37568*, fl. June 1930 (L); S. slope of G. Smeroe, Ranoe Daroengan, *Bijhouwer 209*, fl. May 1932 (B); Besoeki, Djatiroto, *Backer 8104*, fl. May 1913 (B); Djember, *Ultée 15* (B).

Distribution: S.E. Asia (Assam, Burma, Indo China, Malay Peninsula), Malay Archipelago (Sumatra, Java).

Habitat: Thickets, edges of secondary forests, waysides, occasionally on hedges, or as a weed in plantations, between 25 and 1100 m.

Vernacular names: akar boeloe (W. Sumatra); akar santen (W. Sumatra, *Bünnemeyer*); areuj boeloe, wawaloekan (W. Java, *Aarts, Koorders, Zwaardemaker*); samparkidoeng, bongloe (M. Java, *Koorders*); gamet kebo, tjaonan (E. Java, *Koorders*).

Use: According to Boerlage the root is edible (Palaboehan Ratoe).

Specimens from Borneo and from Ambon have the same long patent hairs on the sepals as those from Sumatra and Java, differ, however, in the hairy ovary:

var. **borneense** Van Ooststr., nov. var.

Differt ovario piloso.

BORNEO, without exact locality, *Korthals 186* (L, *type*); S. and E. Division, Martapoera, *Korthals 228* (L); Hayoep, *Winkler 2192*, fl. and fr. May 1908 (B, L).

MOLUCCAS, Ambon, *Robinson 1762*, July-Nov. 1913 (B, L).

Distribution: Only known from Borneo and Ambon.

Habitat: most probably as the species.

Another variety with a hairy ovary and with shorter, less patent, greyish hairs on the sepals can be distinguished as var. *trichocarpum*, based on *Lepistemon trichocarpum* Gagnep.

var. **trichocarpum** (Gagnep.) Van Ooststr., nov. var. — ? *Polemonium obscurum* Blanco, Fl. Filip. (1837) p. 103; id., ed. 2 (1845) p. 75; id., ed. 3, I (1877) p. 139 — *Lepistemon flavescens* auct., non Blume; F.-Vill., Novis App. (1880) p. 142 — *L. binectariferum* auct., non O. K.; Merrill, Fl. Manila (1912) p. 383; id., Spec. Blanc. (1918) p. 321 — *L. trichocarpum* Gagnep. in Not. Syst. III (1915) p. 152 — *L. obscurum* (Blanco) Merrill, Enum. Philipp. Fl. Pl. III (1923) p. 364.

Differt ovario piloso, sepalorum pilis brevioribus, minus patentibus.

CELEBES, Celebes and Dependencies, Soekon, *Kaudern 382*, fl. Sept. 1919 (L, *type*); Manado, Minahassa, way from Singkel to Bola, Bailan, *Koorders 16564* β, fl. Jan. 1895 (B, L).

MOLUCCAS, Kai Islands, *Jaheri 122* (B).

PHILIPPINE ISLANDS; according to Merrill in thickets at low and medium altitudes, often common. Luzon, prov. Benguet, Sablang, *Fénix, Bur. of Sc. 12676*, young fl. Nov.-Dec. 1910 (B); Bontoc distr., *Curran & Merritt, Forestry Bureau 16520*, young fl. Jan. 1909 (L); prov. Union, Bauang, *Elmer 5632*, fl. Febr. 1904 (L); prov. Nueva Vizcaya, vicinity of Dupax, *Mc. Gregor, Bur. of Sc. 11328*, young fl. March-Apr. 1912

(L); prov. Rizal, *Ramos, Bur. of Sc. 707,* fl. Jan. 1911 (U); id., *Ahern's collector, Forestry Bureau 2431,* fl. Jan.-March 1905 (B); id., Pasig, *Merrill, Spec. Blanc. 794* (B, L). Moreover in Bulacan, Bataan and Laguna prov. and in the island of Mindanao: Lanao, Cotabato (according to Merrill).

Distribution: Philippine Islands, Celebes, Kai Islands.

Habitat: thickets, waysides, at low and medium altitudes.

Vernacular names: tali oetan (Tomboeloe language, Minahassa, *Koorders*); baai (Philipp., Bontóc language, *Merrill*); bangbangau-ngbuduan (Philipp., Ilóko language, *Merrill*); pisu (Philipp., Igorot language, *Merrill*).

Remarks: According to Gagnepain the seeds are puberulous.

2. **Lepistemon urceolatum** (R. Br.) F. v. Muell., Syst. Census Austr. Pl. (1882) p. 94; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 128; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 510; Hall. f. in Engl., Bot. Jahrb. XXVIII (1899) p. 31; Schum. & Lauterb., Fl. Deutsch. Schutzgeb. (1901) p. 514; Manson Bailey, Queensl. Fl. IV (1901) p. 1068; id., Compr. Cat. Queensl. Pl. (1909) p. 349; van Ooststr. in Blumea V (1942) p. 233 — *Ipomoea urceolata* R. Br., Prodr. Fl. Austr., ed. 1 (1810) p. 485; Choisy in DC., Prodr. IX (1845) p. 369; Benth., Fl. Austr. IV (1869) p. 427 — *Convolvulus urceolatus* (R. Br.) Spreng., Syst. I (1825) p. 601 — *Lepistemon Fitzalani* F. v. Muell., Fragm. Phyt. Austr. X (1877) p. 111 — *L. Lucae* F. v. Muell. in Vict. Nat. (Oct. 1885) (not seen); Manson Bailey, Queensl. Fl. IV (1901) p. 1068; id., Compr. Cat. Queensl. Pl. (1909) p. 349 — *L. asterostigma* K. Schum. in Engl., Bot. Jahrb. IX (1888) p. 216; Schum. & Hollr., Fl. Kais. Wilh. Land (1889) p. 115; Warb. in Engl., Bot. Jahrb. XIII (1891) p. 412 — *L. spec.* K. Schum. in Engl., Bot. Jahrb. IX (1888) p. 216.

A tall twiner. Stems terete or slightly striate, 2—5 m high, the young parts densely hairy with fulvous, retrorse hairs, the adult parts glabrescent, woody, to 6 mm diam. Leaves petiolate; petiole hairy like the stems, 3—11 cm long; blade broadly ovate to orbicular, acuminate and mucronulate at the apex, cordate or more or less truncate at the base, the lobes entire and broadly rounded or with a large tooth or nearly hastate, the lower surface of the leaves sparingly to densely hairy with short, appressed hairs, sometimes tomentose, the upper surface mostly less hairy, glabrescent; length of blade 5—16 cm, width 3—14 cm. Flowers in few- or mostly in many-flowered, more or less dense, axillary, cymose clusters, which are much shorter than the petiole; the common peduncle very short or almost absent, hairy like the stems; pedicels longer than the calyx, 3—7 mm long, in fruit to 14 mm, more or less pilose. Flowerbuds conical, acute. Sepals subequal, slightly concave, broadly ovate to orbicular, obtuse or slightly emarginate, 2—2.5 mm long, green or yellowish, sometimes reddish, the outer ones hairy with short whitish hairs or nearly or entirely glabrous, the inner ones nearly or entirely glabrous with somewhat scarious margin. Corolla creamy white, urceolate, of about the same form as in *L. binectariferum*, 10—12 mm long, quite glabrous inside and outside or with some hairs outside in the upper part; the limb shortly 5-lobed. Scales at the base of the filaments smaller than in *L. binectariferum*, concave, shortly pilose outside, glabrous inside. Disk half as high as the ovary, slightly

5-lobed. Style shorter than the scales, glabrous; stigma biglobular, papillose. Ovary glabrous, 2-celled. Capsule globular, glabrous, 8—10 mm diam., brownish-black; seeds greyish-black, puberulous, 4 mm long.

CELEBES, Celebes and Dependencies, Pangkadjene, on rocks, *Teysmann 11859* (B, L); id., Tjampeang rock, *Teysmann 12266* (B); Bonthain, *Teysmann 14107* (B); Loewoe, Palopo, *Kjellberg 1953*, fl. and fr. July 1929 (B); Lagih-lagih, *Rachmat 258* (*exped. van Vuuren*), fl. July 1913 (B, L); P. Boeton, Baoe-baoe, *Elbert 2655*, fl. and fr. Sept. 1909 (L); P. Moena, Lombai, *Elbert 2957*, fl. Aug. 1909 (L); Manado, specimens from the Minahassa, collected by *Koorders* are cultivated in the Botanic Gardens at Buitenzorg.

MOLUCCAS, Talaud Islands, Salebaboe, S.E. slope of G. Ajambana, *Lam 3068*, fl. May 1926 (B); Boeroe, Kajeli, *Teysmann*, fl. Aug. (B); Ceram, P. Boano, *Kornassi 1324* (*exped. Rutten*), fl. May 1918 (B, L, U); M. Ceram, Manoesela, *Kornassi 576* (*exped. Rutten*), fl. Nov. 1917 (B, L, U); between Kaniki and Manoesela, *Kornassi 1404* (*exped. Rutten*), fl. June 1918 (B, L, U); S. of Oewrie, *Rutten 2264*, fl. May (B).

NEW GUINEA, Netherlands New Guinea, Doré, *Teysmann s.n.* (B); Hollandia, *Gjellerup 129*, fl. May 1910 (B), id., *Gjellerup 424*, fl. Jan. 1911 (B); near Pionier bivouac, *Lam 565*, fl. July 1920 (B); Territory of New Guinea, Finschhafen, *Hollrung 1*, fl. Apr. 1886 (BD); id., *Hollrung 39*, fl. Apr. 1886 (BD); id., *Hollrung 173*, fl. and fr. June 1886 (B, BD); id., *Weinland 157*, fl. and fr. Oct. 1890 (BD); id., *Lauterbach 417*, fl. July 1890 (BD); id., *Lauterbach 1341*, fl. Jan. 1891 (BD); Sattelberg, *Warburg 21279* (BD); id., *Weber 12*, fl. July 1912 (BD); id., *Clemens 1258*, Dec. 1935 (BD, L); Passai, *Hellwig 644*, fr. Apr. 1889 (BD); id., *Warburg 21279* (BD); id., *Hellwig 277*, fl. Jan. 1889 (BD); Wareo, Morobe, *Clemens s.n.*, fl. Jan. 1936 (BD); Butaueng, *Hellwig 482*, fl. March 1889 (BD); Alexishafen, *Wiesenthal 70* (BD); Stephansort, *Nyman 208 bis*, fl. Apr. 1899 (BD); Mt. Kani, *Schlechter 17502*, fl. March 1908 (BD); Ramu river, Ramu camp, *Rodatz & Klink 10*, fl. June 1899 (BD); Sepik river, 2nd Augusta camp, *Hollrung 885*, fl. Oct. 1887 (BD); id., Malu camp, *Ledermann 7139*, fl. Apr. 1912 (BD); Papua, Western Division, Palmer river, 2 miles below junction Black river, *Brass 7290*, fl. July 1936 (L); Fly river, Everill junction, *Jeswiet 114*, fl. July 1928 (Wag); Lake Daviumbu, Middle Fly river, *Brass 7612*, fl. and fr. Aug. 1936 (L); Kanosia, *Carr 11781*, fl. Apr. 1935 (BD, L); Koitaki, *Carr 11909*, fl. and young fr. Apr. 1935 (BD, L); Isuarava, *Carr 15592*, fl. Febr. 1936 (L).

BISMARCK ARCHIPELAGO, New-Britain, Gazelle Peninsula, Ralum, *Warburg 21278* (BD); New Ireland, Namatanai, *Peekel 247* (BD).

Specimens cultivated in the Botanic Garden at Buitenzorg: *X. F. 48* (B); *X. F. 48a* (B); *X. F. 49* (B, L); *X. F. 58* (L); *XV. H. 46* (B); *Hallier C. 10b* (= *X. F. 48a* and *49*) (L); *Hallier C. 10c* (L); *Hallier C. 10d* (L); *Hallier C. 10e* (L).

Distribution: Celebes, Moluccas, New Guinea, tropical Australia, Solomon Islands (Bougainville Island).

Habitat: in thickets and secondary forests, on more or less moist places between 5 and 1000 m.

Vernacular names: liboeh-liboeh (Celebes, *Rachmat*); kepi, onugo, arra (Territ. of New Guinea, *Lauterbach, Hollrung*); a laklakisu (New Ireland, *Peekel*).

Remarks: 1. The density of the indumentum on the stems and the leaves is as variable as in *L. binectariferum*.

2. It is a curious fact, that, whereas the majority of the specimens has retrorse hairs on pedicels and stems, there are a few ones with hairs directed upwards, towards the leafblade and the top of the stems. (Ceram, *Kornassi 1324, 1404, Rutten 2264*; New Guinea, *Brass 7612, Jeswiet 114*).

XIX. STICTOCARDIA Hall. f.

Hall. f. in Engl., Bot. Jahrb. XVIII (1894) p. 159; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 506 and 514; Koorders, Exk. fl. Java III (1912) p. 124; Merrill, Enum. Philipp. Fl. Pl. III (1923) p. 372 — *Argyreia* Lour. section *Pomifera* Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 184.

Woody or herbaceous twiners. Leaves ovate to orbicular, mostly cordate at the base, entire, the lower surface with many minute glands (black dots in dried specimens). Flowers in axillary, pedunculate, 1—many-flowered cymes; bracts small, deciduous. Sepals elliptic or orbicular, obtuse to emarginate, equal or the outer ones a little shorter, subcoriaceous, often with thinner margin, much accrescent in fruit. Corolla large, regular, funnel-shaped, the midpetaline bands often somewhat pilose outside and with minute glands like the leaves. Stamens and style included. Filaments inserted near the corolla base; pollen globular, spinulose. Ovary glabrous, 4-celled, each cell with 1 ovule; style 1, stigma biglobular. Fruit enclosed by the much enlarged calyx, globular; dissepiments with 2 transverse wings at the surface of the fruit; wall thin, loosing irregularly from the dissepiments and their wings, so that 4 openings become free (fruit then lantern-shaped) through which the 4 pubescent seeds are visible.

Key to the species.

1a. Two outer sepals distinctly cordate at the base, auricles up to 2 mm long . . . . 4. **S. cordatosepala**
b. Outer sepals rounded at the base 2
2a. Sepals 12 mm long or mostly longer. Corolla large, 8—10 cm high . 1. **S. tiliifolia**
b. Sepals less than 12 mm long. Corolla smaller 3
3a. Stems, leaves, peduncles, pedicels and sepals very sparsely pubescent or glabrous. Leaves rather large, 8 cm long or more, long and narrowly acuminate at the apex, deeply cordate at the base . . . . 3. **S. discolor**
b. Stems, leaves, peduncles, pedicels and sepals densely pubescent to tomentose. Leaves smaller, attenuate to slightly acuminate at the apex, shallowly cordate to truncate at the base . . . . 2. **S. neglecta**

1. **Stictocardia tiliifolia** (Desr.) Hall. f. in Engl., Bot. Jahrb. XVIII (1894) p. 159, excl. syn. Bl.; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 131; id. in Bull. Boiss. VI (1898) p. 548; Boerlage, Handl. Fl. Ned. Ind. II (1899) p. 514; Svedelius in Flora XCVI (1906) p. 232, fig. 1—12; Merrill in Philipp. Journ. Sci. III (1908) Bot., p. 429; Hall. f. in Meded. Rijksherb. Leiden 1 (1911) p. 26; Merrill, Fl. Manila (1912) p. 385; Koorders, Exk. fl. Java III (1912) p. 124; Gamble, Fl. Pres. Madras V (1923) p. 904 — *Ipomoea campanulata* L., Spec. Plant. (1753) p. 160, only as to the synonym *Adamboe* of Rheede (cf. van Ooststr. in Blumea III (1940) p. 568); Boldingh, Zakfl. Java (1916) n. 821 — *Convolvulus grandiflorus* L. f., Suppl. (1781) p. 136 — *Convolvulus tiliaefolius* Desr. in Lamk., Encycl. III (1789) p. 544 — *Ipomoea grandiflora* Lamk., Tabl. Encycl. I (1791) p. 467 (cf. van Ooststr. in Blumea III (1940) p. 577—578) — *Convolvulus gangeticus* Roxb., Hort. Beng. (1814) p. 13, nom. nud.; id., Fl. Ind., ed. Carey & Wall., II (1824) p. 46 — *Ipomoea tiliaefolia* R. & S., Syst. IV (1819) p. 229 — *I. benghalensis* R. & S., Syst. IV (1819) p. 229 — *Convolvulus campanulatus* Spreng., Syst. I (1825) p. 608

— *Ipomoea pulchra* Bl., Bijdr. (1825) p. 716 — *I. gangetica* Sweet, Hort. Brit., ed. 2 (1830) p. 288 — *Convolvulus melanostictus* Schlecht. in Linnaea VI (1831) p. 737 — *Rivea tiliaefolia* Choisy in Mém. Soc. Phys. Genève VI (1833) p. 407; id. in DC., Prodr. IX (1845) p. 325 — *Ipomoea melanosticta* G. Don, Gen. Syst. IV (1838) p. 271 — *Argyreia tiliaefolia* Wight, Ic. IV, 2 (1850) p. 12, t. 1358; Miq., Fl. Ned. Ind. II (1857) p. 587; F.-Vill., Nov. App. (1880) p. 139; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 184; Vidal, Phan. Cuming. Philip. (1885) p. 129; id., Rev. Pl. Vasc. Filip. (1886) p. 195; Hillebr., Fl. Hawaiian Isl. (1888) p. 312; Trimen, Handb. Fl. Ceyl. III (1895) p. 206; Gagnep. & Courch., Fl. Indo-Chine IV (1915) p. 274 — *Rivea campanulata* House in Muhlenbergia V (1909) p. 72 — *Stictocardia campanulata* Merrill in Philipp. Journ. Sc. IX (1914) p. 133 (not of House as Merrill states in his Enum. Philipp. Fl. Pl. III (1923) p. 372); id. in Journ. Roy. As. Soc. Str. Br. Spec. Numb. (1921) p. 510 — *Argyreia campanulata* Alston in Trimen, Fl. Ceyl., Suppl. (1931) p. 201. **Fig. 1, g—h.**

A large woody twiner; young parts of the stems terete, often minutely striate, pubescent, finally glabrescent. Leaves petiolate; petiole slender, 3—14 cm long, mostly pubescent; blade 6—20 cm long, 5—20 cm wide, broadly ovate to orbicular, shortly acuminate with mostly obtuse, mucronulate apex, cordate at the base with broad, rounded sinus and rounded lobes; margin entire; upper and lower surface of the leaf more or less densely pubescent or nearly glabrous, the lower surface always with minute black dots (glands); lateral nerves 7—8. Inflorescences axillary, 1—3-flowered; peduncle terete to angular, pubescent, mostly shorter than the petiole, 1.5—7.5 cm long; bracts minute, deciduous; pedicels as long as or much longer than the calyx, slender, pubescent, 10—35 mm long, thickened and elongated in fruit. Sepals orbicular with rounded or slightly emarginate apex, subequal or the interior ones slightly shorter, 12—18 mm long, coriaceous with thinner margins, pubescent outside and more or less glandular with minute black glands like the lower surface of the leaves, or glabrous, much enlarged in fruit, the exterior ones then up to 4, the interior to 5 cm long. Corolla funnel-shaped, reddish purple with a darker centre, 8—10 cm high, the limb 8—10 cm diam., the midpetaline bands sparsely pilose or glabrous and with minute black glands. Stamens and style included; stamens unequal, inserted c. 8 mm above the corolla base; filaments filiform, hairy at their base; anthers lanceolate, c. 5 mm long; ovary 4-celled, glabrous; style filiform, glabrous; stigma biglobular, papillose. Capsule enclosed by the enlarged, finally weathered sepals, globose, 2—3.5 cm diam.; dissepiments with 2 transverse wings at the surface of the fruit; wall thin, loosing irregularly from the dissepiments and their wings, so that 4 openings become free (fruit then lantern-shaped) through which the seeds are visible. Seeds black or dark brown, pubescent, c. 8—9 mm long.

MALAY PENINSULA, P. Timun, P. Langkawi, *Henderson, Singapore Field n. 29113*, fl. Nov. 1934 (B).

SUMATRA, East Coast, Lake Toba, N.W. side, Tongging, *Lörzing 8085*, fl. Nov. 1920 (B).

JAVA, Bantam, Tjaringin, *van Hasselt s.n.*, fl. May 1823 (L); Buitenzorg, Buitenzorg, *Hallier 218a*, fl. and fr. May 1893 (B, L); id., *Hallier 218b*, fl. Apr. 1893

(B, L); Wijnkoopsbaai, Karang Hawoe, *Docters van Leeuwen 14192*, fl. Apr. 1932 (B); Priangan, Tjimahi, *van Slooten 632*, fl. Jan. 1921 (B); Malang, W. of mouth of Kali Srigontjo, *Backer 3914*, fl. June 1912 (B); Madoera, Kangean Islands, Sepandjang, *Backer 28986*, fl. Apr. 1919 (B).

Borneo, Sarawak, according to Merrill in Journ. Roy. As. Soc. Str. Br. Spec. Numb. (1921) p. 510.

Celebes, Pakamisang, *Rachmat 311 (exped. van Vuuren)*, fl. July 1913 (B, L); Todjamboe, *Kjellberg 1862*, fl. July 1929 (B); Salajar, T. Djampea, *Docters van Leeuwen 1595*, fl. May 1913 (B, U); id., Kalao, *Docters van Leeuwen 1526*, fl. May 1913 (B, U).

Lombok, S.W. Lombok, Sepi Mountain, *Elbert 2478*, fr. July 1909 (L).

Moluccas, Soela Islands, P. Soelabesi, *Teysmann s.n.*, fr. July (B); Ambon, Hila, *Reinwardt s.n.*[1]), fl. July 1821 (L); Noesa laoet, *Reinwardt s.n.*[1]), fl. July 1821 (L); Ceram, P. Kelang, Tahaloepoe, *Kornassi 1338*, fl. May 1918 (B).

Philippine Islands; according to Merrill in thickets and secondary forests at low altitudes, often along the seashore and tidal streams. Luzon, prov. Ilocos Norte, Burgos, *Ramos, Bur. of Sc. 27214*, fr. Febr.-March 1917 (B); id., Bangui, *Ramos, Bur. of Sc. 27614*, fr. Febr.-March 1917 (B); prov. Laguna, Calauan, *Mc Gregor, Bur. of Sc. 12385*, fl. Nov.-Dec. 1910 (L). Moreover known from the Batan Islands; Luzon (Cagayan, Benguet, Union, Pangasinan, Bulacan, Rizal, Bataan, Tayabas and Albay); Alabat; Negros; Ticao and Mindanao (according to Merrill).

Distribution: Circumtropical; America: Central America, West Indies; Africa: St. Helena, Cape Verde Islands, Comores, Mascarenes; Asia: British India, Ceylon, Malay Peninsula, Malay Archipelago, Philippine Islands; Australia: Queensland; Pacific Islands.

Habitat: On and behind the beach, in thickets, hedges, and secondary forests, sometimes also in more elevated parts, between 0 and 925 m.

Vernacular names: areuj tatapajan gede (sund., Java, *Koorders*); katabor (Celebes, *Rachmat*); halalei (P. Kelang, Ceram, *Kornassi*); bulákan (Philipp., Tagálog and Súlu language, *Merrill*); burákan-maputí (Philipp., Samar-Leyte Bisáya language, *Merrill*); kal-kalauag (Philipp., Ilóko language, *Merrill*); tibulbúl (Philipp., Bíkol language, *Merrill*).

Remarks: See Blumea III (1940) p. 568, under *Ipomoea illustris* (Clarke) Prain and l. c. p. 577—578, under *Ipomoea tuba* (Schlechtend.) Don.

2. Stictocardia neglecta Van Ooststr., nov. spec. **Fig. 1, i—j.**

Description of the type specimen, *Walsh 373* (B) from Lombok (the data in parentheses have reference to the other specimens mentioned below).

Planta volubilis, caulibus teretibus dense breviter pilosis vel in partibus junioribus tomentosis, denique glabrescentibus lignescentibus, ad 3(—4) mm crassis. Folia petiolata, petiolis tenuibus breviter pilosis supra leviter sulcatis 2.5—7 cm longis, ovata vel late ovata 4—8 cm longa 3—5.5 (—6) cm lata apice attenuata vel acuminata, acumine acutiusculo

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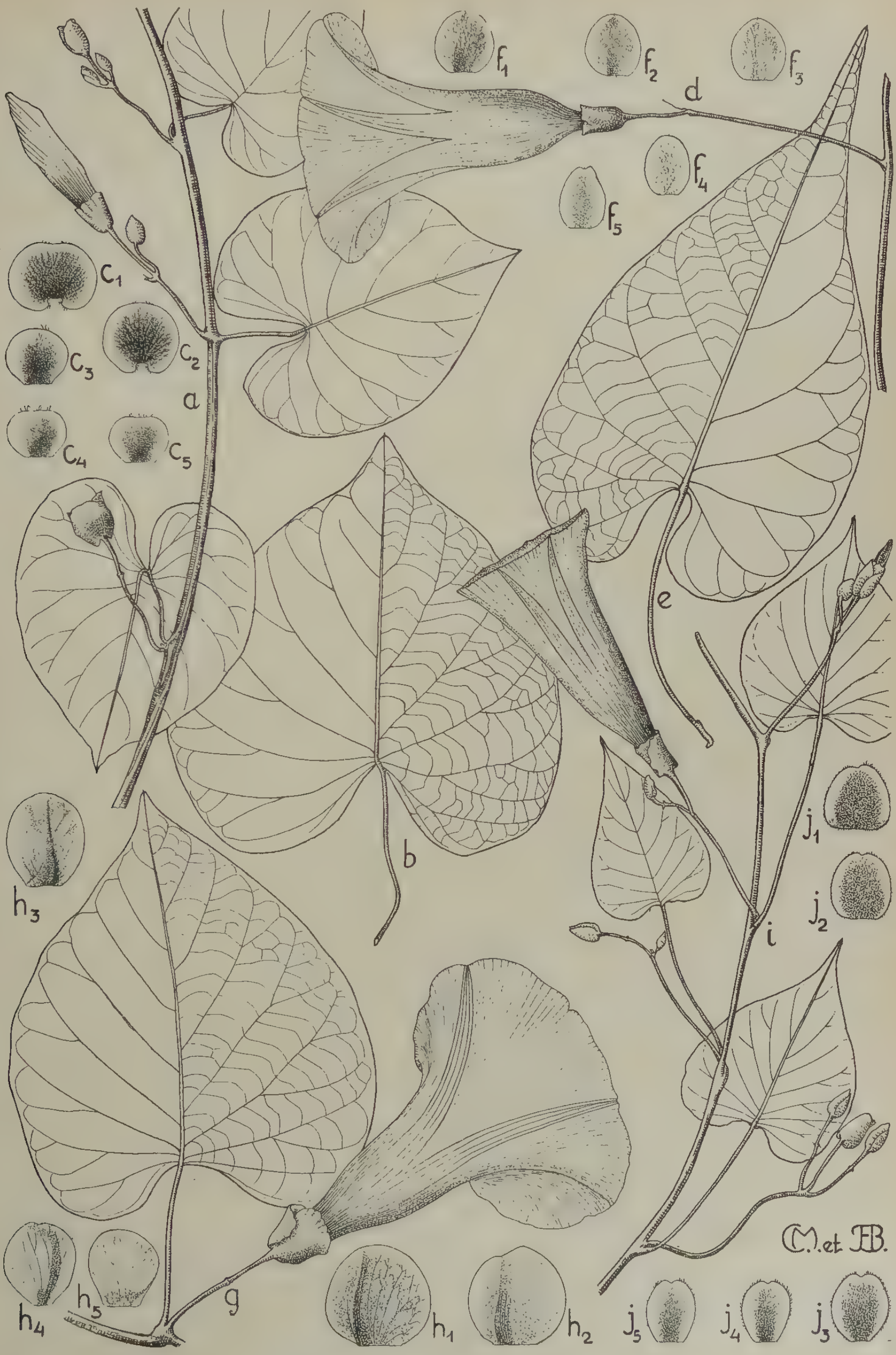
[1] Type specimens of *Ipomoea pulchra* Bl.

Fig. 1. a: *Stictocardia cordatosepala* Van Ooststr., branch of the type specimen, *Elbert 2011*, L; b: *id.*, leaf of the type specimen; c_1-c_5: *id.*, sepals 1—5; d: *Stictocardia discolor* Van Ooststr., branch of the type specimen, *Reinwardt 1350*, L; e: *id.*, leaf of the type specimen; f_1-f_5: *id.*, sepals 1—5; g: *Stictocardia tiliifolia* (Desr.) Hall. f., branch of the type of *Ipomoea pulchra* Bl., *Reinwardt s.n.* from Ambon, L; h_1-h_5: *id.*, sepals 1—5; i: *Stictocardia neglecta* Van Ooststr., branch of the type specimen, *Walsh 373*, B; j_1-j_5: *id.*, sepals 1—5. Branches and leaves $^4/_7$ × nat. size, sepals ± nat. size.


a
b
c1
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CM. et FB.

Fig. 1.

minutissime mucronulato, basi obscure cordata vel subtruncata, margine integra, utrinque viridia (vel subtus rubra), dense breviter pilosa vel juniora tomentosa, subtus glandulis multis minutissimis punctiformibus nigris praedita, nervis lateralibus utrinque 7—8, eorum 3—4 e basi orientibus. Inflorescentiae axillares pedunculatae apice 1-florae, vel cymoso-ramosae 2—3 (—4)-florae, pedunculis teretibus ut caules breviter pilosis (0.5—) 2—5 cm longis, ramis interdum ad 2.5 cm longis; bracteae minutae, mox deciduae; pedicelli ut pedunculi breviter pilosi (5—) 10—18 mm longi (sub fructu incrassati). Sepala subaequilonga vel exteriora paullo breviora, externe dense breviter pilosa vel tomentosa, tenuiter coriacea, marginibus membranaceis, exteriora 2 late ovata vel late elliptica vel orbicularia apice paullo emarginata basi rotundata 8—11 mm longa 8—10.5 mm lata, interiora 3 late elliptica apice paullo emarginata basi rotundata margine apicem versus fimbriata c. 10 mm longa et 8.5 mm lata. Corolla violacea (*Jonker*) tubuloso-infundibuliformis c. 5—6 cm longa, limbo externe breviter piloso, caeterum glabra. Stamina inclusa, filamentis glabris basi breviter pilosis c. 8 mm supra basin corollae insertis, antheris lineari-lanceolatis. Discus annularis c. 0.5 mm altus obscure lobatus. Ovarium glabrum 4-locellatum; stylus filiformis glaber c. 32 mm longus, stigmate biglobulare papilloso. (Fructus subglobosus c. 1.5 cm diam. probabiliter 4-locellatus, sepalis valde accretis ad 3—3.5 cm longis arcte involucratus, pericarpio tenui fragili; semina 4 subovoidea 7—8 mm longa 5.5—6 mm lata brevissime tomentosa).

CELEBES, Celebes and Dependencies, Pangkadjene, on rocks, *Teysmann 12171*, fl. and fr. (B, L); Salajar, *Zollinger 3327*, fl. (L).

TIMOR, without exact locality, *Jonker 290*, fl. (U); Koepang, *Teysmann s.n.*, fr. (B, *typus fructuum*); Lololi, *Teysmann s.n.* (B); South Middle Timor, Ofoe, *Walsh 373*, fl. May 1929 (B, *typus florum*); id., id., *Walsh 107*, fl. May 1929 (BD).

WETAR, *Treub 546*, young fr. (B).

Distribution: Celebes, Lesser Sunda Islands.

Habitat: the type specimen, *Walsh 373*, was collected in Timor at 900 m altitude, the specimen *Walsh 107* at c. 540 m. According to Walsh the species is common in Timor ("many and everywhere").

Vernacular name: non lakoe (Timor, *Walsh*).

Remarks: 1. The specimen *Walsh 373* from Timor, Ofoe, can be considered as the *typus florum*, the specimen *Teysmann s.n.* from Timor, Koepang, as the *typus fructuum*.

2. According to a label annotation the leaves of the specimen *Teysmann s.n.* from Timor, Lololi, are red.

3. **Stictocardia discolor** Van Ooststr., nom. nov. — *Ipomoea discolor* Reinw. in sched. — *I. pulchra* Bl. var. *foliis acuminatis cum mucrone, pedunculis petiolo longioribus* Bl., Bijdr. (1825) p. 716 — *Stictocardia pulchra* Hall. f. in Bull. Herb. Boiss. V (1897) p. 380 and in Bull. Herb. Boiss. VI (1898) p. 548, as to the Timor specimens, not *Ipomoea pulchra* Bl.; Boerlage, Handl. Fl. Ned. Ind. II (1899) p. 514. **Fig. 1, d—f.**

A twiner with thin, slender, sparsely pubescent or glabrous stems. Leaves petiolate; petiole slender, 4—7 cm long, sparsely pubescent; blade 8—15 cm long, 4—7.5 cm wide, ovate, acuminate, with long and narrow, obtuse or acutish, mucronulate acumen, deeply cordate at the base, with rounded sinus and lobes; margin entire; sparsely and minutely pubescent

on both sides, more densely on the nerves beneath, or nearly glabrous, the lower surface reddish (always?) with minute black dots (glands); lateral nerves 7—10. Inflorescences axillary, 1—2-flowered; peduncle terete, thin, sparsely pubescent or nearly glabrous, 2—5 cm long; bracts minute, 1.5 mm long (only one present in the type specimen), deciduous; pedicels longer than the calyx, slender, sparsely pubescent or glabrous, 15—30 mm long. Sepals coriaceous with membranaceous margins, subequal, the exterior ones orbicular to broadly elliptic, broadly rounded at the apex, rounded at the base, 9—11 mm long, sparsely pubescent outside, shortly ciliate in the upper part; the interior ones broadly elliptic, 9—10 mm long, all with minute glands outside. Corolla funnel-shaped, probably 6—8 cm high, the midpetaline bands sparsely pilose outside and with minute black glands like the lower surface of the leaves, or glabrous. Capsule unknown.

TIMOR, without exact locality, *Reinwardt 1350,* named *Ipomoea discolor* Reinw. in sched. (L, *type*).

Distribution: Only known from Timor.

Habitat: unknown.

Remarks: 1. Blume used the name *I. pulchra* for two specimens collected by Reinwardt in the Moluccas (Ambon and Noesa laoet). Both belong to *Stictocardia tiliifolia.* A specimen from Timor he distinguished as a variety: "variet.: foliis acuminatis cum mucrone, pedunculis petiolo longioribus". Hallier incorrectly used the name *Stictocardia pulchra* for this variety and not for the specimens of Blume's *Ipomoea pulchra* as appears from specimens in the Rijksherbarium at Leiden. As the combination *Stictocardia pulchra* can only be based on *Ipomoea pulchra* Bl. itself and as the variety distinguished by Blume represents, in my opinion, a well-characterized species, I propose a new name for it, *Stictocardia discolor.*

2. *S. discolor* can be distinguished from *S. tiliifolia,* the type of the genus, mainly by the much more slender stems and peduncles, the smaller sepals and corolla and the long acuminate leafblades with a red lower surface.

4. Stictocardia cordatosepala Van Ooststr., nov. spec. **Fig. 1, a—c.**

Planta volubilis, caulibus teretibus substriatis, partibus junioribus breviter pilosis mox glabrescentibus vel glabris, partibus adultioribus probabiliter lignescentibus ad 4 mm crassis. Folia petiolata, petiolis tenuibus breviter pilosis vel glabris supra sulcatis 3—9 cm longis, late ovata vel orbicularia, 6—12 cm longa 5—12 cm lata apicem versus attenuata vel breviter acuminata, acumine obtusiusculo minutissime mucronulato, basi late cordata, margine integra, supra viridia subglabra vel glabra, subtus rubra glandulis minutissimis punctiformibus nigris praedita, caeterum glabra vel in nervis breviter pilosa; nervi laterales utrinque 6—7, eorum c. 3 e basi orientes. Inflorescentiae axillares pedunculatae apice 1-florae, vel cymoso-ramosae 2—3-florae; pedunculi teretes glabri vel praesertim apicem versus breviter pilosi 1—9 cm longi; bracteae oblongae obtusae margine membranaceae 3—5 mm longae deciduae; pedicelli sparse breviter pilosi 10—35 mm longi. Sepala coriacea marginibus membranacea, exteriora 2 orbicularia vel late transverso-elliptica apice late rotundata vel paullo emarginata basi cordata auriculis distinctis c. 2 mm longis fimbriatis, 12 mm

longa 12—14 mm lata, interiora 3 ± orbicularia basi rotundata 8—9 mm longa 8.5—10 mm lata, externe glandulis minutissimis punctiformibus praedita sparse pilosa vel apice breviter ciliato excepto glabra. Corolla in sicco violacea infundibuliformis prob. ± 6 cm longa, fasciis mesopetalis externe glandulis minutissimis praeditis, margine fimbriata. Stamina inclusa, filamentis glabris basi breviter pilosis. Discus annularis sub-5-lobatus. Ovarium glabrum 4-locellatum; stylus inclusus filiformis glaber, stigmate biglobulare papilloso. Fructus ignotus.

LOMBOK, Rindjani volcano, S.E. side, S. slope of Poessoek, Sapit valley, *Elbert 1890,* fl. June 1909 (L); id., S.S.E. side, Iwela near Pringabaya, *Elbert 2011,* fl. June 1909 (L, *type*).

Distribution: Only known from Lombok.

Habitat: The specimen *Elbert 1890* in monsoon forest, on loamy soil, between 600 and 700 m; the specimen *Elbert 2011* in thin forest in rather moist tract, on loamy soil, between 350 and 700 m.

Remarks: A species closely related to *S. discolor,* but distinguished by the larger outer sepals which have a remarkable cordate base and by the less narrowly acuminate, broader leafblades. Moreover, the stems and peduncles seem to be somewhat stouter than in *S. discolor.*

XX. ARGYREIA Lour.[1]

Lour., Fl. Cochinch. (1790) p. 134; Choisy in Mém. Soc. Phys. Genève VI (1833) p. 412; id. in DC., Prodr. IX (1845) p. 328; Miq., Fl. Ned. Ind. II (1857) p. 585; Benth. & Hook., Gen. Plant. II (1876) p. 869; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 184; Baill., Hist. Pl. X (1891) p. 323; Peter in Engl. & Prantl, Nat. Pfl. fam. IV, 3a (1891) p. 20; Hall. f. in Engl., Bot. Jahrb. XVI (1893) p. 585; Trimen, Handb. Fl. Ceyl. III (1895) p. 206; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 506, 513; Prain in Journ. As. Soc. Bengal LXXIV (1906) p. 320; Koorders, Exk. fl. Java III (1912) p. 123; Gagnep. & Courch. in Lec., Fl. Indo-Chine IV (1915) p. 272; Ridley, Fl. Malay Penins. II (1923) p. 448; Merrill, Enum. Philipp. Fl. Pl. III (1923) p. 371; Backer, Onkruidfl. Jav. Suikerrietgr. (1931) p. 531 — *Lettsomia* Roxb., Fl. Ind., ed. Carey & Wall., II (1824) p. 75; id., ed. Carey, I (1832) p. 487; Miq., Fl. Ned. Ind. II (1857) p. 591; Benth. & Hook., Gen. Plant. II (1876) p. 870; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 191; Baill., Hist. Pl. X (1891) p. 323; Peter in Engl. & Prantl, Nat. Pfl. fam. IV, 3a (1891) p. 21; Trimen, Handb. Fl. Ceyl. III (1895) p. 209; Prain in Journ. As. Soc. Bengal LXXIV (1906) p. 321; Ridley, Fl. Malay Penins. II (1923) p. 449 — *Moorcroftia* Choisy in Mém. Soc. Phys. Genève VI (1833) p. 431; id. in DC., Prodr. IX (1845) p. 334 — *Rivea* Choisy in Mém. Soc. Phys. Genève VI (1833) p. 407, emend. Hall. f., in part (see remarks).

Climbing, very rarely suberect shrubs. Leaves very variable in form

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[1] The manner in which the genus *Argyreia* has been treated in this paper, is somewhat different from that of the foregoing genera in as far as only the species from the Malay Archipelago s.s. have been mentioned. Those from the Malay Peninsula and from the Philippine Islands will be elaborated afterwards in a special paper, as soon as the materials concerned are again available.

and size, mostly entire, hairy, rarely glabrous. Inflorescences axillary, cymose, few- or many-flowered, loose or compact to capitate; bracts minute or large; flowers large, medium-sized or small. Sepals 5, herbaceous or subcoriaceous, very variable in form and size, mostly hairy without, glabrous within, slightly or sometimes much enlarged in fruit and then often red within. Corolla regular, campanulate, funnel-shaped or tubular, purple, red, rose or white; limb plicate and nearly entire or very shortly lobed or deeply lobed, with 5 well-defined hairy midpetaline bands without and with glabrous connecting fields; in deeply lobed corollas the lobes consisting of a midpetaline band with two narrow glabrous wings. Stamens 5, inserted near the base or sometimes near the mouth of the corolla tube, included or exserted; filaments filiform, often dilated at the base, more or less unequal in length; anthers oblong or linear; pollen globular, spinulose. Disk annular or cupular, entire or shallowly lobed. Ovary glabrous, 2- or 4-celled, 4-ovuled; style filiform, included or exserted; stigma biglobular. Fruit a globose or ellipsoid berry, fleshy, leathery or mealy, purplish, red, orange red or yellowish. Seeds glabrous, 4 or less.

Distribution: Tropical Asia, Malay Archipelago, Philippine Islands.

Remarks. 1. The genus *Argyreia*, as described by Loureiro in 1790 in his Flora Cochinchinensis, p. 134, contained 3 species, *A. obtusifolia* Lour. (l. c. p. 134), *A. acuta* Lour. (l. c. p. 135) and *A. arborea* Lour. (l. c. p. 135). Two of these, viz. *A. obtusifolia* and *A. acuta* doubtless belong to the family Convolvulaceae as representatives of a well-defined genus. The third, *A. arborea* considerably differs from the others and it was Hallier who identified it with the borraginaceous *Cordia Myxa* L. (cf. Hallier in Bull. Herb. Boiss. VI, 1898, p. 716). Loureiro described his new genus as having a 5-partite corolla with oblong reflexed segments, a capitate emarginate stigma and a subglobular, 4-celled berry (and a 4-celled ovary, but Loureiro did not mention this).

In 1824, in the first edition of the Flora Indica II, p. 75, Roxburgh established the genus *Lettsomia*, mainly with the same characters, but differing in its 2-celled ovary. He subdivided this genus into two groups, one with a campanulate corolla, the other with an infundibuliform (or rather hypocrateriform) one. From his description it becomes clear that the species of the first group have a biglobular stigma, whereas the stigmas are linear in the second group.

Choisy, in Mém. Soc. Phys. Genève VI, 1833, p. 412, mentioned the genus *Lettsomia* as a synonym of *Argyreia*, at least as to the species with a campanulate corolla and a biglobular stigma. The other species he united into a new genus, *Rivea*. One of these, *R. tiliaefolia*, is a rather aberrant one and has been transferred afterwards to *Stictocardia* by Hallier. The genus *Rivea* is mainly distinct from *Argyreia* by its linear to oblong stigmas and from *Ipomoea* by the same character and by the indehiscent instead of valvate fruit.

In 1845, in his treatment of the Convolvulaceae in DC., Prodromus, Choisy once again mentioned *Argyreia* with *Lettsomia p. p.* as a synonym and so did Hallier in Engl., Bot. Jahrb., 1893. They are followed among others by Boerlage (1899) and by Gagnepain & Courchet (1915). The last-named authors adduce arguments in support of their opinion by saying: "*Argyreia* Lour. présente un ovaire à quatre loges; *Lettsomia* n'en présente que 2. C'est toute la différence. On trouve des cas où les cloisons supplémentaires sont indiquées seulement sur le paroi; ce sont donc des fausses cloisons. Leur présence ou absence ne paraissent pas d'ordre générique".

Other authors, however, such as Miquel (1857), Bentham & Hooker (1876), Clarke (1883), Baillon (1891), Peter (1891), Trimen (1895), Prain (1906) and Ridley (1923) keep the two genera separate, several of them with some hesitation. Miquel, for instance, writes under *Lettsomia*, l. c. p. 591: "Argyreiae forsan nimis affinis". Prain in Journ. As. Soc. Bengal LXIII, 1894, p. 91 also points out that the only difference between *Argyreia* and *Lettsomia* consists in the ovary being completely 4-celled in the former, 2-celled in the latter; not unfrequently, however, a partial dissepiment is found at the base of the cell in *Lettsomia*. But though he writes that he quite agrees (l. c. p. 92, line 1) with Collett and Hemsley's opinion, expressed in Journ. Linn. Soc. XXVIII, p. 95, that *Lettsomia* and *Argyreia* deserve to be re-united, he keeps the genera separate.

Once again they are kept separate in Prain's paper on the Convolvulaceae in Journ. As. Soc. Bengal LXXIV, 1906, p. 320 and 321, where he, however, again expresses his doubt by stating that "there is not, as the writer has already explained (*Journ. As. Soc. Beng.* LXIII, 2, 91), any very good reason for retaining *Lettsomia* as a genus apart from *Argyreia*".

Ridley, 1923, p. 49, mentions under his description of *Lettsomia* that this genus is very near *Argyreia* and passes into it! Nevertheless, he describes the two genera apart from each other.

In my opinion, *Argyreia* and *Lettsomia* can be combined without any difficulties under the name of the former genus. In keeping them apart, several species which are doubtless very nearly related should have to be inserted in different genera. The differences in the number of cells of the ovary appears to be of little value in several genera of the family Convolvulaceae. It was Hallier, 1893, who pointed this out already and the present author quite agrees with this opinion. Moreover the species formerly inserted in *Lettsomia* have so many characters in common with those of *Argyreia* (deeply or shallowly lobed corollas in both, lax or capitate inflorescences in both, hairy midpetaline bands, berrylike fruits, characters in habit, kinds of hairiness) that a separation of the two genera would be a very unnatural one.

2. As to *Moorcroftia* Choisy it is clear that the two species of it described by Choisy belong to *Argyreia*. There is not a single reason to distinguish them as representatives of a separate genus.

3. As has already been stated above, it was Choisy, 1833, who established the genus *Rivea*, based on the species of *Lettsomia* with linear-oblong stigmas and with an indehiscent, dry or nearly dry fruit. In 1845 the very natural limits of *Rivea* became blurred, when he added several American species of *Ipomoea* to it, all with biglobular stigmas. Other authors, however, have maintained the original limits of the genus [Bentham & Hooker (1876); Clarke (1883); Baillon (1891); Hallier (1893)]. After-

wards it becomes clear that Hallier has altered his opinion, for in Engl., Bot. Jahrb. XVIII, 1894, p. 155, he describes *Rivea* in a much widened sense, adding to it several African and American species with a biglobular stigma. The group of species originally described as *Rivea* he distinguishes as a section *Eurivea*. The African and American species he unites in two other sections, *Poliothamnus* and *Legendrea*, the first of which he canceled afterwards as its species, on account of the 4-valved capsules and long-haired seeds which were formerly unknown (Hallier in Sitz. ber. Kais. Akad. Wien, Math.-naturw. Cl., CVII, Abt. I, 1898, p. 51) had better be placed in *Ipomoea* sect. *Eriospermum*. In Bull. Herb. Boiss. V, 1897, p. 381, Hallier again distinguishes a new section, *Samudra* (Endl.), based on *R. nervosa* (Burm.) Hall. f. Later on he mentions a section *Moorcroftia* (in Bull. Herb. Boiss. VI, 1898, p. 714) and a section *Sycadenia* (in Jahrb. Hamb. Wiss. Anst. XVI, 1899, 3. Beih., p. 11—16), the former confined to tropical Asia and the adjacent islands, the latter to Africa. He adds that it is not impossible that some other sections could be created on the ground of a few aberrant African species.

In my opinion, *Rivea* has to be brought back to its previous limits, as indicated by Choisy in 1833 and corresponding with Hallier's section *Eurivea*. The species of *Poliothamnus* as stated above belong to *Ipomoea*. *Legendrea* has to be given generic rank with *L. corymbosa* ¹) as the type species. The species belonging to *Samudra* and *Moorcroftia* ²) have to be transferred to *Argyreia*. As to *Sycadenia* and some other African species, I can not yet give a definite opinion, as these species are unfortunately unsufficiently known to me. It is possible that they represent one or more distinct genera nearly related to *Legendrea* or that they may be partly united with this.

Following this procedure, the representatives of *Argyreia* are confined to tropical Asia, the Malay Archipelago and the Philippine Islands; *Rivea* only occurs in tropical Asia. *Legendrea* is of American origin, with one representative also in the Canary Islands.

4. Only a thorough knowledge of all species of *Argyreia* can give a satisfactory insight in the natural subdivision of this intricate genus. For the time being, I considered the character whether the corolla is nearly entire or distinctly 5-lobed a feature of primary importance. The same subdivision we find already in Don's General System IV, 1838, p. 254 and 256 (Section *Ptychanthus* Don: "Corolla nearly entire, with 5 plaits

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¹) **Legendrea corymbosa** (L.) Van Ooststr., nov. comb. — *Convolvulus corymbosus* L., Syst., ed. 10 (1759) p. 923 — *Ipomoea Burmanni* Choisy in DC., Prodr. IX (1845) p. 350 — *I. sidaefolia* Choisy in Mém. Soc. Phys. Genève VI (1833) p. 459; id. in DC., Prodr. IX (1845) p. 372 — *Rivea corymbosa* (L.) Hall. f. in Engl., Bot. Jahrb. XVIII (1894) p. 157; Merrill, Fl. Manila (1912) p. 387; id., Enum. Philipp. Fl. Pl. III (1923) p. 371.

According to Merrill, 1923, introduced in the Philippine Islands from tropical America; in some places now spontaneous in thickets and secondary forests. Merrill mentions specimens from Luzon (Bulacan, Rizal, Laguna).

L. mollissima Webb & Berth., from the Canary Islands is a pubescent variety, var. *mollissima* (Webb & Berth.) Hall. f. in Engl., Bot. Jahrb. XVIII (1894) p. 157 (= **L. corymbosa** (L.) Van Ooststr. var. **mollissima** (Webb & Berth.) Van Ooststr.).

²) Here belong most of the species afterwards described by Hallier, Elmer and Merrill from the Malay Archipelago and the Philippine Islands.

at top. Stamens inclosed" and section *Schizanthus* Don: "Corolla 5-cleft, or 5-parted at the apex. Stamens exserted") and in Endlicher's Genera Plantarum, 1839, p. 655 (Section *Samudra* Endl.: "Corollae limbus plicatus subinteger. Stamina inclusa" and section *Euargyreia* Endl. "Corollae limbus quinquefidus. Stamina exserta").

Further I first treated in each group the species with a lax inflorescence followed by those with a more compact or capitate one.

Key to the species.

1a. Limb of corolla shallowly lobed or nearly entire . . . 2
b. Limb of corolla deeply 5-lobed to 5-parted . . . 11
2a. Cymes capitate or sub-capitate; bracts large, persistent . . . 10
b. Cymes mostly lax; bracts small or rarely large, deciduous, occasionally with a casual foliaceous persistent bract in the cyme . . . 3
3a. Bracts large, outer ones 3.5—5 cm long, ovate to oblong or elliptic, long and narrowly acuminate. Leaves large, ovate, deeply cordate, glabrous or nearly so above, densely white-tomentose beneath. Peduncles long, stout. Corolla large, c. 6 cm long . . . **6. A. nervosa**
b. Bracts smaller. Leaf base not deeply cordate . . . 4
4a. Sepals narrowly lanceolate, acute, patently hirsute. Leaves hairy on both sides, elliptic or elliptic-oblong, base rounded or slightly cordate. Corolla c. 2 cm long . . . **8. A. adpressa**
b. Sepals oblong, ovate or elliptic, obtuse, very rarely acutish, never patently hirsute . . . 5
5a. Sepals glabrous or very sparsely pilose; the inner cucullate, afterwards (always ?) deeply emarginate by tearing of the apex . . . **7. A. cucullata**
b. Sepals densely sericeous or tomentose; inner ones not cucullate . . . 6
6a. Sepals equal or subequal . . . 7
b. Outer sepals much longer than inner ones . . . 9
7a. Stamens and style much shorter than corolla; corolla 5 cm long or more. Lower surface of leaves densely sericeous, silvery white or pale fulvous . . . **1. A. mollis**
b. Stamens and style about as long as or longer than corolla; corolla smaller . . . 8
8a. Stamens and style about as long as the corolla or shortly exserted. Sepals broadly elliptic. Lower leaf surface densely pilose to tomentose with short curled hairs . . . **3. A. Walshae**
b. Stamens and style long exserted. Sepals ovate or oblong. Lower leaf surface sericeous . . . **5. A. sumbawana**
9a. Sepals inside glabrous or nearly so. Upper surface of leaves glabrous or nearly so, lower surface sparsely pilose with very short, appressed, straight hairs. Leafblade ovate to oblong . . . **2. A. Reinwardtiana**
b. Sepals inside densely pubescent. Upper surface of leaves densely sericeous, lower surface tomentose with short curled hairs. Leafblade ovate . . . **4. A. bifrons**
10a. Sepals lanceolate, acuminate, hirsute, outer ones 15—17 mm long. Peduncles mostly exceeding the petioles. Leaves ovate-cordate . . . **9. A. capitata**
b. Outer sepals ovate, acute, glabrous or hairy, 6—7 mm long. Peduncles at most as long as the petioles. Leaves elliptic or oblong, base rounded or shortly attenuate into the petiole . . . **10. A. Ridleyi**
11a. Outer sepals distinctly acuminate. Segments of corolla linear, 18—20 mm long. Leaves caudate to cuspidate at apex . . . **18. A. caudata**
b. Sepals never acuminate, mostly obtuse, very rarely acutish . . . 12
12a. Sepals densely hirsute-strigillose as are the peduncles and the pedicels. Leaves ovate or elliptic, glabrous above or with a few hairs on the nerves, strigillose beneath . . . **13. A. erinacea**
b. Sepals, pedicels and peduncles not hirsute-strigillose . . . 13
13a. Inflorescences densely capitate; bracts spathulate to orbicular, 8—12 mm long. Outer sepals obovate to spathulate, 9—10 mm long, inner slightly shorter, all tomentose without . . . **19. A. aggregata**

b. Inflorescences lax. Sepals smaller, equal in length or the inner ones longer than the outer 14

14a. Inner sepals 6—6.5 mm long, outer ones slightly shorter 15

b. Sepals equal or subequal, 2.5—3 mm, sometimes up to 4 mm long 16

15a. Leaves densely appressed-hairy beneath, glabrous or nearly so above. Pedicels shorter than the calyx, 1—4 mm long, in fruit 4—10 mm. Bracts triangular to orbicular, minute. Base of filaments with a large tooth . **11. A. rubicunda**

b. Leaves ± glabrous on both sides. Pedicels longer than the calyx, 7—9 mm long, in fruit up to 18 mm. Bracts linear, larger. Base of filaments without tooth . . . . **12. A. glabra**

16a. Leaves with a minute crisped pubescence beneath. Pedicels 1—2 mm long. Corolla small; tube cylindrical, 2.5—3.5 mm long; lobes oblong, 5.5—6 mm long . . . . **14. A. cinerea**

b. Leaves sparsely hairy beneath, with straight appressed hairs, or glabrous . 17

17a. Leaves ovate-oblong or elliptic-oblong [1]), margins not parallel, shortly appressed-pilose on both sides, glabrescent. Pedicels 2.5—5 mm long. Two inner sepals transverse-elliptic with broadly rounded apex. Corolla tube cylindrical, 4—5 mm long; lobes oblong, 8—10 mm long. Sepals in fruit 5—6 mm long. Berry broadly ellipsoid, c. 12 mm long. . . . . **15. A. micrantha**

b. Leaves oblong or narrowly oblong with almost parallel margins, glabrous or nearly so. Pedicels 2—3 mm long. Two inner sepals broadly ovate-triangular, attenuate towards the apex. Corolla tube gradually widened towards the limb, 5—6 mm long; lobes ovate-oblong, c. 9 mm long. Sepals in fruit 3—4 mm long. Berry ellipsoid, c. 15 mm long . . . . **16. A. oblongifolia**

20. A. Robinsonii and **21. A. parviflora** are unknown to me.

1. **Argyreia mollis** (Burm. f.) Choisy in Mém. Soc. Phys. Genève VI (1833) p. 421; id. in DC., Prodr. IX (1845) p. 331; Zoll., Syst. Verz., 2. Hft. (1854) p. 128; Miq., Fl. Ned. Ind. II (1857) p. 588; id., Fl. Ned. Ind., Suppl. (1860) p. 234; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 131; id. in Bull. Herb. Boiss. V (1897) p. 381; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513; Hall. f. in Meded. Rijksherb. Leiden 12 (1912) p. 14; Koorders, Exk. Fl. Java III (1912) p. 123; Koorders-Schum., Syst. Verz. I (1910—13), Conv. p. 7; Bold., Zakfl. Java (1916) n. 799; Merrill in Philipp. Journ. Sc. XIX (1921) p. 375; Ridley, Fl. Malay Penins. II (1923) p. 449; Beumée in Hand. 3e Ned. Ind. Natuurw. Congr. (1924) p. 178; Heyne, Nutt. Pl. Ned. Ind., ed. 2 (1927) p. 1306; Backer, Onkruidfl. Jav. Suikerrietgr. (1931) p. 531 — *Convolvulus sericeus* L., Mant. I (1767) p. 43, not of Burman (1768), not *Argyreia sericea* Dalz. & Gibs. — *Convolvulus mollis* Burm. f., Fl. Ind. (1768) p. 44, tab. 17 — *Ipomoea sericea* (L.) Blume, Bijdr. (1825) p. 720 — *Argyreia argentata* Miq., Fl. Ned. Ind. II (1857) p. 588; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513; Koorders, Exk. Fl. Java III (1912) p. 123 — ? *Lettsomia argentea* Ridley in Journ. Fed. Malay States Mus. VII (1916) p. 47.

A woody twiner, up to 10 m high. Stems with white milky juice, terete or finely ribbed, young parts densely appressed-pilose with whitish or pale fulvous hairs, glabrescent, occasionally more or less farinose, the old parts up to 10 mm thick, brownish or greyish. Leaves petiolate, the petiole 1—6 cm long, shortly appressed-pilose; the blade rather variable in form, elliptic to oblong or narrowly oblong, sometimes ovate or lanceolate, the base acute or somewhat attenuate into the petiole, or rounded, never cordate, the apex acute or short-acuminate, mucronulate, or obtuse (in broad leaves as well as in narrower ones), 4—15 cm long, 2—7 cm broad, the upper surface densely of sparsely appressed-hairy or glabrous or only with hairs along the nerves, the lower surface densely sericeo-tomentose, with silvery white or pale fulvous hairs or sometimes the indument much less dense; lateral nerves 9—18 (—20) on each side of the midrib, straight, curved near the margin, prominent beneath. Inflorescences axillary, along the main-stems or on short lateral branches, solitary or occasionally two in a leaf axil; the peduncle shorter to slightly longer than the petiole, slightly angular, softly hairy, 5—25, sometimes up to 45 mm long, with 1 to 5, rarely with more flowers; pedicels 5—15 mm long, hairy like the peduncle, angular; bracts obovate-oblong, obtuse, glabrous or almost glabrous inside, densely sericeo-lanate outside, deciduous. Sepals about equal in length, 2 exterior ones broadly elliptic, obtuse, 8—10 mm long, the third and fourth sepal elliptic to elliptic-oblong, obtuse to slightly emarginate, the fifth oblong, slightly emarginate, all densely sericeo-lanate outside and glabrous inside, all enlarged in fruit, and then 12—14 mm long, concave, patent, red or purplish inside. Corolla pale violet or pink with a white base, sometimes entirely white, large, funnel-shaped to campanulate, 5.5—9 cm high, attenuate towards the base into a narrow tube, 8—10 mm long; the limb shallowly lobed; the midpetaline bands outside pilose with rather long, appressed hairs, the basal part of the corolla and the connecting fields glabrous. Stamens and style much shorter than the corolla; filaments inserted at the mouth of the short tube, sparsely pilose at the base, 15—18 mm long, anthers 4 mm long. Disk annular, nearly 1 mm high. Ovary conical, glabrous, 4-celled. Style c. 30 mm long; stigmas globular, papillose. Fruit subglobose, red or orange red, c. 8—10 mm diam., 4- or less-seeded. Seeds smooth, black, about 5 mm long.

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[1]) **17. A. celebica** of which the flowers are unknown, has oblong-lanceolate or ovate-oblong, glabrous leaves; margins not parallel. Sepals in fruit 3—4 mm long. Berry ellipsoid, c. 10 mm long.

SUMATRA, East Coast, without exact locality, *Yates 1212* (B); Asahan, Goerach Batoe, *Yates 1948* (B); Lampong Districts, Natar, *Teysmann, H. B. 4332* (B, L, U).

JAVA, without exact locality, *Blume s.n.* (L, U); *Junghuhn s.n.* (L); *Korthals 257* (L); *Reinwardt s.n.* (L); *De Vriese 214* (L); *Waitz s.n.* (L); Bantam, between Tjileles and G. Kentjana, *Backer 1206*, fl. June 1911 (B); between Tjitorek and Moentjong, *Backer 1848*, fl. June 1911 (B); Batavia, Batavia, *Vorderman s.n.* (B); id., *Hallier s.n.*, fr. Aug. 1896 (L); Tandjong Priok, *Backer 35442*, fl. May 1903 (B); Weltevreden, *Backer 35441* (B); Bidara tjina, *Edeling ? s.n.* (B); Tanah abang, *Hallier s.n.*, fr. Aug. 1896 (B); Tjikampek, *Boedijn (herb. Van Steenis 3060)*, fr. Aug. 1929 (B); Kemajoran, *Backer 35443*, fl. June 1903 (B); Karendang, *Backer 35440*, fr. March 1903 (B); Krawang, *De Monchy 151*, fl. July 1891 (B); Poerwakarta, *Backer 13982*, fr. June 1914 (B); Tjikoempaj estate, E. of Poerwakarta, *Harmsen 103*, st. Dec. 1921 (B); Buitenzorg, Buitenzorg, *Reinwardt s.n.* (L); id., *Hallier 216 a*, st. Apr. 1893 (B); id., *Hallier 216 b*, fl. Apr. 1893 (L); id., *Hallier s.n.*, st. Oct. 1894 (B); island in Tjiliwoeng, Botanic Garden, Buitenzorg, *Hallier 216 b*, fl. Apr. 1893 (B); Depok, *Hallier s.n.*, st. Aug. 1896 (B); id., *Soegandiredja 245*, fl. May 1900 (B, L); id., *Koorders 44070 β*, fr. July 1918 (B, L); id., *Beumée 6011*, fl. Apr. 1923 (B); G. Wangoen, *Soegandiredja 220*, fl. May 1900 (B); Rawa Tjampea, *Reinwardt s.n.* (L); limestone rocks of Tjiseeng, Koeripan, *Backer 30834 bis*, fl. May 1920 (B); Tjipetir, *Burck & De Monchy s.n.* (B); Takoka, *Koorders 15279 β*, fl. Febr. 1894 (B); Tjisaroea, near Tjikidang, *Bakhuizen van den Brink 1475*, fl. June 1907 (B); Tjisaroea, *Raap 894*, fr. July 1896 (L); Kiara Pajoeng, N. of Tjiandjoer, *Zwaardemaker 75*, fl. Apr. 1918 (B); id., *Backer 23674* and *23760*, fl. March 1918 (B); hills S. of Tjibeber, *Backer 13411*, fl. May 1914 (B, L); G. Boeleud, S. of Tjibeber, *Winckel 362 β*, fl. June 1919 (B);

G. Beser, near Tjidadap, S. of Tjibeber, *Winckel 1157β*, fl. May 1917 (B); Tjidadap, Tjibeber, *Bakhuizen van den Brink 876*, fl. May 1916 (B, L); Batoe Karoet, Tjidadap, *Winckel 353* and *353β*, fl. May 1919 (B, L); Tjitibo, Tjidadap, *Bakhuizen van den Brink 2102*, fl. May 1916 (B); Priangan, Bandoeng, *Ploem s.n.* (B, L); near Telaga bodas, *A. J. K.* (?) *229*, fl. May 1913 (B); Tjikorai, *Burck 369*, fl. June 1891 (B); N. slope of G. Boerangrang, *Backer 14147*, fr. June 1914 (B); Tjipanas, *Van der Pijl 605*, fr. July 1936 (B); Tasikmalaja, *Koorders 44309β*, fr. Aug. 1917 (B); id., Noesagede island in lake of Pendjaloe, *Koorders 47918β*, fr. July 1917 (B); Cheribon, Losarang, *Backer 16751*, fr. Sept. 1914 (B); Madjalengka, *Beumée 1756*, young fl. March 1918 (B); Pekalongan, forestry E. Tegal, *Beumée 1882*, young fl. March 1918 (B); forestry Margasari, *Beumée 5134*, fl. Apr. 1920 (B); Magelang, N.E. of mouth of K. Loekoela, *Brinkman 494*, fl. Aug. 1931 (B); Semarang, Grobogan, forestry S. Kradenan, *De Boer 2*, fl. May (B); Karang balong, *Lörzing 1693*, fl. June 1914 (B); Kedoeng djati, *Koorders 28233β*, fr. June 1897 (B); id., G. Woelan, *Koorders 28092 β*, fl. June 1897 (B, L); Sugar factory Rendeng, *without coll. name* (L); Salatiga, source of K. Sindjojo, *Docters van Leeuwen s.n.*, fl. March 1909 (B); Sepokoeng, *Koorders 35788 β*; fl. May 1899 (B); Telemojo, *Koorders 27707 β*, fl. June 1897 (B, L); Oengaran, N. slope, *Junghuhn s.n.*, fl. Apr. (L), the same sheet bears two more labels, indicating Jogjakarta and G. Gambing as the collecting locality); Djapara-Rembang, Ngarengan, *Koorders 33513 β*, fl. May 1899 (B, L); id., *Koorders 35599 β*, fl. May 1899 (B); forestry Bekoetoek, *Blokhuis s.n.*, fl. March 1919 (B); forestry Doplang, *Beumée 973*, fr. Aug. 1917 (B); Soerakarta, *Horsfield s.n.* (L; U, *type* of *Argyreia argentata* Miq.); Klaten, *Leefmans 102*, fr. Sept. 1922 (B); Telawah, *Koorders 28231 β*, fl. June 1897 (B, L); Jogjakarta, between Jogjakarta and Wonosari, *Backer 2528*, fl. Apr. 1912 (B); Madioen, Ngawi, *Soeradji 9*, fl. May 1918 (B); Karang anjar, *Stoutjesdijk 26, 112, 133, 134*, fl. and fr. June, July 1921 (B); Ngebel, *Koorders 23900β*, fl. May 1896 (B, L); id., *Koorders 29191β*, fr. Aug. 1897 (L); Pilangredjo, *Wisse 94*, fr. July 1919 (B); Tjerong forest, Ponorogo, *Koorders 29191 β*, fr. Aug. 1897 (B, U); Trinil, *Elbert 364* (L); Kediri, Berbek, *Beumée 2244*, young fl. Apr. 1918 (B); id., *Grutterink 3053*, fl. June 1918 (B); G. Pandan, *Grutterink 3030*, fl. June 1918 (B); Soerabaja, Soerabaja, *Dorgelo 275*, fl. Apr. 1922 (L); id., *Dorgelo 503*, fl. June 1922 (L); id., *Dorgelo 745*, fl. July 1922 (L); forest district S. Soerabaja, Medowo, *Beumée 2642*, fl. May 1918 (B); above Patjet, *Altmann 66*, fl. Apr. 1932 (B); Wonokromo, *Van Slooten 2066*, fr. Sept. 1928 (B); Malang, G. Semongkrong, E. of Pasoeroean, *Backer 7705*, fl. May 1913 (B, L); Bantoer, S. of Gondang legi, *Backer 3861*, fl. June 1912 (B); Poerwodadi, N.E. of Lawang, *Backer 36187*, st. Apr. 1930 (L); Malang, *Wisse s.n.*, fl. June 1920 (B); Tangkil, *Koorders 23808 β*, st. June 1896 (B); G. Anjar, G. Lamongan, *Heyning 7*, fl. Apr. 1933 (B); G. Bentar near Probolinggo, fl. alb., *Backer 24335*, fl. June 1918 (B); Besoeki, Djember, *Ultée 14* (B); Poeger, *Koorders 21072 β*, fl. and fr. Oct. 1895 (B, L); id., *Koorders 21073β, 21074β, 21081 β*, fl. and fr. Oct. 1895 (B); Pradjekan, *Backer 24573*, fl. June 1918 (B); Madoera, Pegantenan, *Vorderman 79* (B); Kangean Archipelago, Kangean, S. of Ardjasa, *Backer 27369*, st. March 1919 (B); id., dessa Doeko, *Dommers 35*, fr. Sept. 1919 (B); id., Pandeman, *Beguin V 3*, fl. June 1919 (B); id., kali Sangka, *Beguin E 4*, fl. June 1919 (B); Sepandjang, *Backer 28954*, st. Apr. 1919 (B).

Bali, Batoer, *De Voogd 2028*, fl. May 1935 (B); Brambang, *Sarip 16 (exped. R. Maier)*, fl. July 1918 (B, L); Galioekir, *De Voogd 2464*, fl. May 1936 (B).

Cultivated specimens: *Hort. Bog. XV. G. 68* (B); id. *XV. G. 69*, *Wigman Jr.*, fl. and fr. Oct. 1910 (B); id. *XV. G. 69a*, *Wigman Jr.*, fr. Oct. 1910 (B); id., *Pulle s.n.*, fl. (U); id., seedlings, *Hallier C 170 b*, Dec. 1894 (L).

Distribution: Malay Peninsula (according to Ridley, 1923), Sumatra, Java, Bali.

Habitat: Thickets, secondary forests, teak woods, lava fields, alang fields, waysides, occasionally in hedges; between 1 and 1500 m.

Vernacular names: areuj tatapajan, tatapajan (sund., W. Java, *Blume, Koorders, de Monchy, Soegandiredja, Winckel*); tatajan gedé (sund., W. Java, *Blume, Miquel*); areuj koejapoe (sund., W. Java, *Blume, Miquel*); podol landak (sund., W. Java, *Bakhuizen van den Brink, Winckel*); kihoei (sund., W. Java, *Koorders*); kemarogan, kelawatan (javan., M. Java, *Koorders*); rambatan (javan., M. Java, *Brinkman*); toeloepan (javan., M. Java, *Backer, Junghuhn, Koorders*); oeloek oeloek (javan., E. Java, *Koorders*); rabet po-sepo (Madoera, *Backer, Koorders*); sepo sepoan (Kangean Arch., *Dommers*); boentetoeloepan (Bali, *Sarip*).

2. **Argyreia Reinwardtiana** (Bl.) Miq., Fl. Ned. Ind. II (1857) p. 589; Forbes, Wander., Germ. ed. II (1886) p. 222; Hall. f. in Bull. Herb. Boiss. V (1897) p. 381; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513 — *Ipomoea Reinwardtiana* Bl., Bijdr. (1825) p. 720; Hall. f. in Bull. Boiss. V (1897) p. 381 — *Argyreia Guichenotii* Choisy in Mém. Soc. Phys. Genève VI (1833) p. 423 with exception of the synonym *Ipomoea pulchra* Bl., which belongs to *Stictocardia tiliifolia* (Desr.) Hall. f.; Decaisne, Herb. Timor. (1835) p. 61; Spanoghe in Linnaeà XV (1841) p. 338; Choisy in DC., Prodr. IX (1845) p. 331, excl. specim. et syn. Bl.; Miq., Fl. Ned. Ind. II (1857) p. 589, excl. syn. Bl. et specim. Jav.; Forbes, Wander., Germ. ed. II (1886) p. 222; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513 — *Convolvulus Reinwardtianus* (Bl.) D. Dietr., Syn. Pl. I (1839) p. 675 — *C. ovatus* Reinw. mss. ex Choisy in DC., Prodr. IX (1845) p. 332, in syn.

A woody twiner. Stems terete, the young parts sparsely pilose with very short, appressed whitish hairs, later on lignescent and glabrous, dark or pale brown, lenticellate, up to 4 mm diam. Leaves petiolate; petiole shortly appressed-pilose like the stems, slender, 3—5 cm long; blade herbaceous or chartaceous, entire, ovate, ovate-oblong or elliptic-oblong, 5.5—17 cm long, 3—10 cm broad, rounded, truncate or very slightly cordate at the base, attenuate or acuminate at the apex, minutely mucronate, glabrous or nearly so above, sparsely to rather densely pilose beneath with short appressed, straight hairs; midrib and 8—10 pairs of lateral nerves rather prominent beneath; minute venation reticulate beneath. Inflorescences axillary; peduncles much shorter than the petioles, 1—2.5 cm long, rather densely pilose, with minute whitish hairs, cymosely 2—few-flowered; bracts linear to oblong, appressed-pilose beneath, glabrous or nearly so above, 8—15 mm long, c. 3 mm broad; pedicels hairy like the peduncles, 3—5 mm long. Sepals unequal, the outer ones much longer than the inner, with ± undulate margins; two outer ones ovate, acutish, outside densely sericeous, sometimes less densely towards the apex, inside glabrous or nearly so, (12—) 15—18 mm long; third sepal narrow-elliptic, obtuse, c. 13 mm long; two inner ones elliptic to ovate-oblong, obtuse, 8—9 mm long, densely whitish sericeous outside, sometimes with exception of the membranaceous margins, which are glabrous but finely ciliate (in the specimen collected by *Spanoghe* the outer sepals are, at least partly, broadly ovate to orbicular, obtuse, c. 13 mm long, the inner ones ovate to broad-ovate, c. 7 mm long); sepals accrescent in fruit, outer ones up to 20 mm long, red inside. Corolla purplish pink (*Walsh*), funnel-shaped, c. 4—4.5 cm long; limb shallowly lobed, c. 3.5—4 cm diam.; tube glabrous at the base, densely sericeous towards the limb; midpetaline bands sericeous like the upper portion of the tube; connecting fields glabrous. Stamens and style nearly as long as the corolla; filaments slightly unequal, inserted near the base of the corolla tube, c. 3 cm long, glabrous except for the base; anthers sagittate, c. 5 mm long. Disk annular, nearly 1 mm high. Ovary 2-celled, glabrous, style glabrous, stigmas papillose. Fruit presumably a rather dry berry, in the *Teysmann* specimen depressed-globose, 7—10 mm diam., 2—4-seeded. Seeds glabrous, with 1 flat and 1 convex side if 2, and with 2 flat and 1 convex side, if 4 are present, c. 5.5 mm long (ripe?).

Timor, without exact locality, *Reinwardt 1351,* named *Convolvulus ovatus* Reinw. in sched., fl. (L, *type*); id., *Spanoghe s.n.*, named *Ipomoea speciosa* L.f., by Spanoghe, fl. (L); Nonbaun, *Teysmann s.n.*, fr. (B); South Middle Timor, Soë, *Walsh 153,* fl. March 1929 (B).

Distribution: Only known from Timor.

Habitat: The specimen *Walsh 153* between limestone rocks, at 850 m altitude.

Remarks: 1. The description of *A. Guichenotii* Choisy so well agrees with the specimens of *A. Reinwardtiana*, that the two species are doubtless identic.

2. The form of the sepals is rather variable; in the type the óuter ones are acute or acutish, in other specimens they are sometimes partly or all obtuse or broadly rounded; in *A. Guichenotii* they are described as being very obtuse.

3. It is not impossible that the specimen from Timor mentioned by Choisy in Mém. Soc. Phys. Genève VI (1833) p. 425; id. in DC., Prodr. IX (1845) p. 332 under *Argyreia setosa* Choisy, belongs to *A. Reinwardtiana* (Bl.) Miq. See also Decaisne, Herb. Timor. (1835) p. 61; Spanoghe in Linnaea XV (1841) p. 338; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513.

3. **Argyreia Walshae** Van Ooststr., nov. spec. **Fig. 2, n—p.**

Frutex scandens, ramulis teretibus, in sicco longitudinaliter rugosis, fulvis vel cinereis, glabris vel sparse breviter pilosis vel farinosis, adultioribus ad 6 mm diam. lenticellatis solidis. Folia petiolata, petiolis gracilibus breviter pubescentibus ad 10 cm longis, laminis late ovatis vel ovatis, apice acutis vel paullo acuminatis mucronulatis, basi rotundatis vel paullo emarginatis, superioribus 5—6 cm longis, 2.5—3.5 cm latis, adultioribus ad 16 cm longis 13 cm latis, supra sparse adpresseque pilosis, pilis albidis, glabrescentibus, subtus dense pubescentibus vel breviter tomentosis, pilis crispatis fulvo-cinereis, nervo mediano et nervis lateralibus utrinque 9—12 subtus prominentibus. Inflorescentiae axillares, apice umbellato-cymosae, 4—12- (vel multi-, ad 20-) florae, pedunculis quam petioli brevioribus vel eis aequantibus 1—6 cm longis ut pedicelli et calyces sordide albo- (vel cinereo-fulvo-) tomentosis, pedicellis 3—6 mm longis, apice incrassatis, bracteis lanceolatis vel linearibus, subtus tomentosis, supra glabris. Sepala subaequalia late elliptica obtusa 6—8 mm longa, externe tomentosa, interne glabra brunnea. Corolla tubuloso-infundibuliformis 2—2.8 cm longa, limbo obscure lobato, fasciis mesopetalis et tubo in parte superiore sericeis, ceterum glabra. Stamina ut stylus paullo exserta, filamenta c. 5 mm supra basin corollae inserta, ad 20 mm longa, basi pilosa; antherae 3.5—4 mm longae; stylus filiformis c. 20—25 mm longus, stigmata globosa papillosa; ovarium glabrum 2-locellatum; discus annulatus c. 1 mm altus. Fructus deest.

Timor, without exact locality, *Jonker 273,* young fl. Apr. (U); Beloe, Tobaki (Naïtimoe), *Walsh 388,* fl. June 1929 (B, *type*).

Distribution: Only known from Timor.

Habitat: The type specimen was collected at 800 m altitude; according to Mrs. Walsh rather frequent in Timor.

Remarks: 1. Named in honour of Mrs. M. E. Walsh, who, during her stay in Timor has made important botanical and entomological collections, supplying in this way many valuable contributions to the knowledge of the flora and fauna of the island.

2. According to Jonker the young corollas of his specimen are pale green with greyish midpetaline bands.

4. **Argyreia bifrons** Van Ooststr., nov. spec. **Fig. 2, t.**

Frutex scandens, ramulis junioribus dense pubescentibus vel farinosis teretibus substriatis cinereo-brunneis solidis ad 4 mm diam. Folia breviter petiolata, petiolis 1—2 cm longis dense breviterque cinereo- vel olivaceo-tomentosis, laminis ovatis, basi truncatis vel emarginatis, apice acutis vel breviter acuminatis, 5—10 cm longis 3.5—6.5 cm latis, supra dense adpresseque cinereo- vel olivaceo-sericeis nitidis, subtus dense breviterque crispato-tomentosis pallidioribus cinereis vel olivaceis opacis, nervo mediano et nervis lateralibus utrinque 10—14 subtus prominentibus. Inflorescentiae axillares, pedunculis quam petioli multo longioribus, in sicco angulatis vel sulcatis 6—10 cm longis breviter tomentosis, apice umbellato-cymosis, multifloris, pedicellis in floribus junioribus (adultiores desunt) ad 5 mm longis, bracteis oblongis vel anguste spathulatis, utrinque dense breviterque pubescentibus vel tomentosis, 6 mm longis. Sepala utrinque dense pubescentia vel tomentosa, inaequalia, exteriora 2 oblonga apice obtusa vel paullo emarginata 8—9 mm longa c. 4.5 mm lata, sepalum tertium paullo angustius et brevius obtusum c. 6.5 mm longum, sepala interiora 2 late elliptica obtusa 5 mm longa 4 mm lata. Corolla infundibuliformis laete violacea (*Rensch*), fasciis mesopetalis sericeis, ceterum glabra. Filamenta prope basin corollae inserta filiformia, basi pilosa. Ovarium 2-loculare glabrum. Stylus filiformis; stigmata globosa papillosa. Discus annulatus sublobatus.

Lombok, Ekas, *Mrs. Rensch 454* (B, *type*).

Distribution: Only known from Lombok.

Habitat: Twining on trees and shrubs, frequent (according to Mrs. Rensch) and collected between 5—10 m altitude.

Remarks: 1. The specific name *bifrons* refers to the striking difference in hairiness of the upper and lower surface of the leaves.

2. The young flowers of the type specimen do not yet permit a close examination of the form and dimensions of the corolla, stamens and pistil.

5. **Argyreia sumbawana** Van Ooststr., nov. spec. — *Rivea sumbawana*

Fig. 2. a: *Argyreia oblongifolia* Van Ooststr., branch of the type specimen, Endert 4509, B; b: *id.*, fruits; c_1—c_5: *id.*, sepals 1—5; d—e: *id.*, segment of corolla (outside) and stamen, showing place of insertion of the latter; f: *Argyreia celebica* Van Ooststr., fruiting branch of the type specimen, Koorders 18214β, L; g: *id.*, leaf; h: *Argyreia pedicellata* Van Ooststr., fruiting branch of the type specimen, Elmer 8439, L; i: *id.*, fruit of the specimen Clemens s.n., from Mindanao; j: *id.*, leaf; k: *Argyreia cucullata* Van Ooststr., inflorescences of the type specimen, Lörzing 8514, L; l: *id.*, leaf; m_1—m_5: *id.*, sepals 1—5; n: *Argyreia Walshae* Van Ooststr., inflorescence of the type specimen, Walsh 388, B; o: *id.*, leaf; p_1—p_5: *id.*, sepals 1—5; q—r: *Argyreia sumbawana* Van Ooststr., branches of the type specimen, Colfs 318, L; s_1—s_5: *id.*, sepals 1—5; t_1—t_5: *Argyreia bifrons* Van Ooststr., sepals of the type specimen, Mrs. Rensch 454, B. Branches, leaves and fruits (a, b, f, g, h, i, j, k, l, n, o, q, r) ½ × nat. size; sepals (c, m, p, s, t) 3 × nat. size; corolla segment and stamen (d, e) 1½ × nat. size.

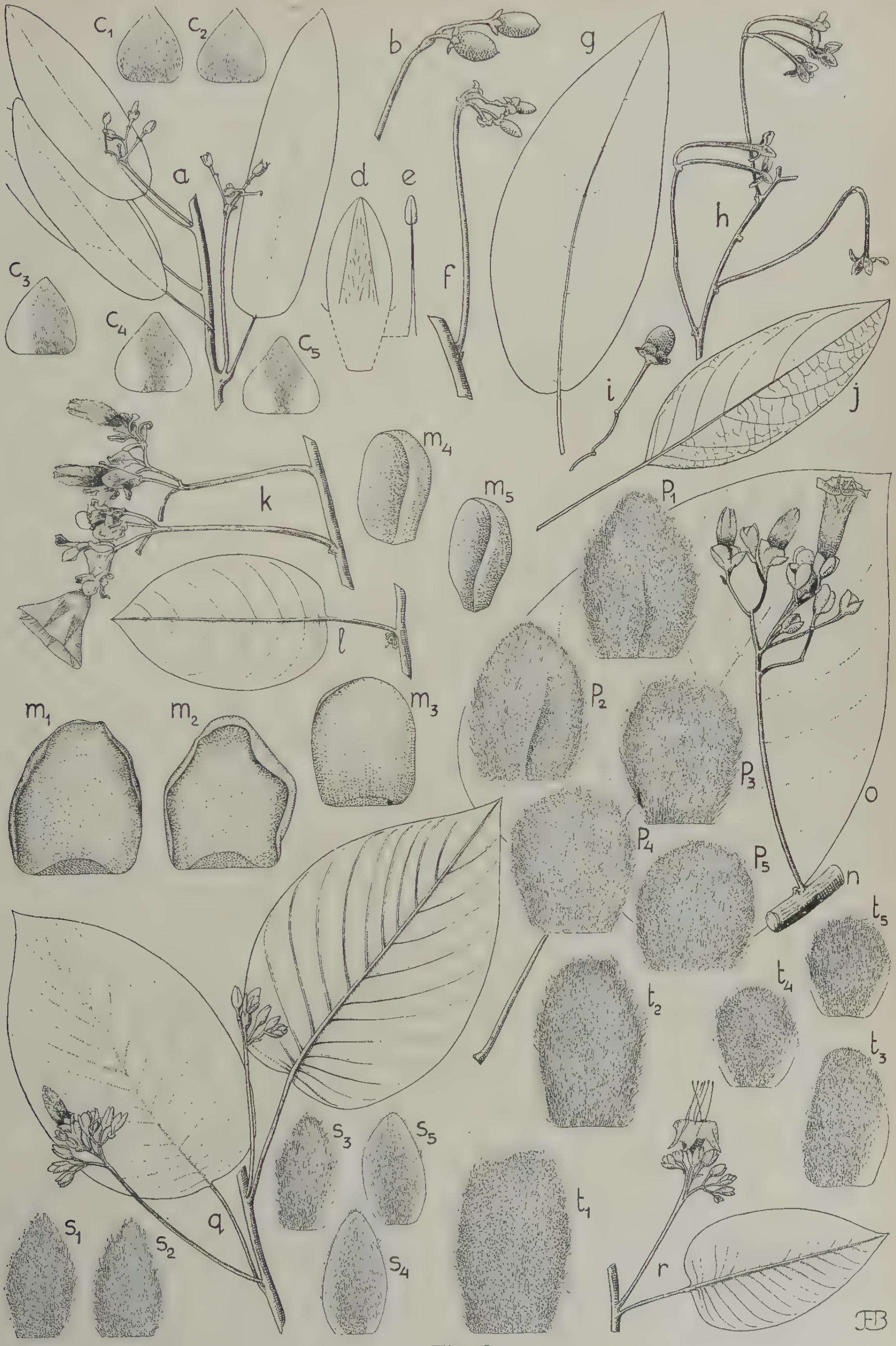
c1
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Fig. 2.

Hall. f. in Elbert, Sunda-Exped. II (1912) p. 281, nomen nudum. **Fig. 2, q—s.**

Description of the type specimen, *Colfs 318* (L); the data in parentheses refer to the other specimens mentioned below:

Frutex scandens, ramulis junioribus teretibus dense adpresseque pubescentibus vel farinosis pallide fulvis, adultioribus interdum longitudinaliter rugosis lenticellatis farinosis vel glabris solidis ad 5 mm diam. Folia petiolata, petiolis dense adpresseque breviter pubescentibus 2.5—6 cm longis, laminis ovatis, basi paullo emarginatis vel truncatis (vel in petiolos brevissime attenuatis), apice breviter acuminatis acutis mucronulatis, 6—13 cm longis 3—8.5 cm latis, supra dense adpresseque sericeis, subtus dense breviterque sericeo-tomentosis pallidioribus pallide fulvis, nervo mediano et nervis primariis utrinque (9—)10—14 subtus prominentibus supra leviter impressis. Inflorescentiae axillares, pedunculis gracilibus teretibus vel subangulatis, quam petioli longioribus 3—7(—11) cm longis, apice umbellato-cymosis, ut rami cymae et pedicelli dense pubescentibus vel farinosis; pedicelli 4—8 mm longi; bracteae minutae ovato-lanceolatae acutae, externe dense pubescentes, interne subglabrae, mox deciduae. Sepala aequalia (vel paullo inaequalia), externe dense interne sparse praesertim apicem versus adpresse pubescentia vel interne glabra, exteriora 2 ovato-oblonga vel ovato-triangularia (vel oblonga) obtusa 5.5(—6.5) mm longa (2—)3 mm lata; sepalum tertium anguste ellipticum (vel oblongum paullo obliquum) 5.5(—6.5) mm longum (2.5—)3(—3.5) mm latum; sepala interiora 2 ovata vel ovato-triangularia, apicem obtusum versus attenuata, marginibus tenuioribus, 5(—6) mm longa 3(—4) mm lata. Corolla rosea vel pallide roseo-purpurea tubulosa vel infundibuliformis c. 2.5 cm longa; tubus c. 1.3 cm longus c. 7 mm supra basin dilatatus; limbus obscure lobatus, denique reflexus; pars superior tubi et fascii mesopetali (c. 12 mm longi) sericei. Stamina ut stylus exserta. Filamenta c. 7 mm supra basin corollae inserta, basi dense pilosa, pilis crassis, (10—)14(—19) mm longa, antherae c. (2.5—) 3.5—4 mm longae; stylus filiformis c. 20(—24) mm longus; stigmata globosa papillosa; ovarium glabrum 4-locellatum. Discus annulatus subinteger (vel obscure 5-lobatus) c. 1 mm altus. Fructus deest.

SOEMBAWA, without exact locality, *Colfs 318*, fl. Nov. 1879 (L, *type*); Soembawa-besar, *Mrs. Rensch 484*, fl. Apr. 1927 (B); West Soembawa, near Lenangoean, *De Voogd 2730*, fl. June 1936 (B).

Distribution: Only known from Soembawa.

Habitat: The specimen *Rensch 484* in dry thickets, at 50 m altitude, rather frequent; the specimen *de Voogd 2730* in open places, at 500 m alt.

Remarks: Whereas the outer sepals in the type specimen are ovate to ovate-oblong they are narrower in the two other specimens, especially in that collected by *de Voogd*.

6. **Argyreia nervosa** (Burm. f.) Bojer, Hort. Maurit. (1837) p. 224 (not seen); Merr., Fl. Manila (1912) p. 386; id., Enum. Philipp. Fl. Pl. III (1923) p. 371 — *Convolvulus nervosus* Burm. f., Fl. Ind. (1768) p. 48, tab. 20, fig. 1 — *C. speciosus* L. f., Suppl. (1781) p. 137, excl. patria — *Ipomoea speciosa* (L. f.) Pers., Syn. Pl. I (1805) p. 183; Curtis, Bot. Mag. (1824) t. 2446; Blume, Bijdr. (1825) p. 381 — *Lettsomia speciosa* (L. f.) Roxb.,

Hort. Bengal. (1814) p. 13, nomen — *L. nervosa* (Burm. f.) Roxb., Fl. Ind., ed. Carey & Wall., II (1824) p. 78; id., ed. Carey, I (1832) p. 488 — *Argyreia speciosa* (L. f.) Sweet, Hort. Brit. (1827) p. 289; Choisy in Mém. Soc. Phys. Genève VI (1833) p. 411; id. in DC., Prodr. IX (1845) p. 328; Wight, Icon. III (1844—45) t. 851 (*Argeriea s.*); Zoll., Syst. Verz., 2. Heft (1854) p. 127; Hassk., Retzia I (1855) p. 68; Miq., Fl. Ned. Ind. II (1857) p. 585; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 185; Hillebr., Fl. Hawaiian Isl. (1888) p. 312; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 131; Cooke, Fl. Bombay II (1905) p. 255; Duthie, Fl. Upper Ganget. Pl. II (1911) p. 120; Bold., Zakfl. Java (1916) n. 799; Gamble, Fl. Pres. Madras V (1923) p. 907 — *Rivea nervosa* (Burm. f.) Hall. f. in Bull. Herb. Boiss. V (1897) p. 381; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513; Koorders, Exk. Fl. Java III (1912) p. 123.

A large climber, with milky, viscid juice (*Wight*). Stems 5—10 m high, robust, terete, densely minutely tomentose, whitish or fulvous. Leaves large, ovate to orbicular, 10 to 30 cm or more long, 8 to 25 cm or more broad, the apex obtuse or acute to shortly cuspidate, mucronulate, the base deeply cordate; upper surface glabrous or nearly so, lower surface densely fulvous to greyish or white sericeo-tomentose, shining; midrib and 11—15 nerves on each side of it prominent beneath, minor nerves many, parallel between the primary lateral ones; petiole shorter than or as long as the blade, tomentose like the stems. Flowers in a subcapitate cyme at the end of a stout peduncle, this peduncle tomentose like the stems, terete, attaining a length of 20 cm or more. Bracts large, ovate to oblong or elliptic, with long and narrow acumen, thinly membranaceous, veined, softly pilose outside, glabrous inside, 3.5—5 cm long, deciduous; pedicels short, angular. Sepals almost equal in length or the interior ones a little shorter, all densely whitish tomentose outside, glabrous inside, the two outer ones broadly elliptic, obtuse or acutish, up to 15 mm long, the 3 inner ones broadly elliptic to orbicular, obtuse, about 10—12 mm long. Corolla rose-purple, large, tubular to funnel-shaped, constricted at the base into a narrow tube, and with a slightly lobed limb; about 6 cm long, the tube 6—7 mm; corolla densely appressed white sericeo-lanate without, with exception of the connecting fields between the midpetaline bands and the most basal part of the corolla, glabrous within. Stamens and style included. Filaments inserted at the mouth of the short tube, pilose at their bases, different in length, 13—18 mm long; anthers about 5.5 mm long. Ovary glabrous, 4-celled; style filiform, nearly 30 mm long; disk annular. Fruit globose, apiculate, c. 2 cm diam., yellowish brown, nearly dry (according to Clarke).

SUMATRA, Atjeh and Dependencies, Poeloe Weh, Sabang, along road to the lake, *Van Slooten 820,* fl. May 1928 (B).

JAVA, Batavia, Weltevreden, cult., *Backer 34295,* fl. Apr. 1905 (B); Buitenzorg, Buitenzorg, Tjikeumeuh, cult., *Hallier 217,* fl. May 1893 (B); Semarang, Semarang, cult., *Backer 37350,* fl. July 1929 (L); Jogjakarta, Jogjakarta, cult., *Backer 12059,* fl. March 1914 (B); Malang, Pasoeroean, cult., according to Backer in sched.

Distribution: Originally in British India, from Assam and Bengal to Belgaum and Mysore, cultivated in other tropical countries; occasionally escaped from culture.

Vernacular names: elephant creeper; areuj boöl kebo, areuj bohol kebak (keboh) (sund., W. Java, *Hasskarl, Koorders, Miquel*).

Use: Cultivated in gardens for ornamental purposes.

7. **Argyreia cucullata** Van Ooststr., nov. spec. **Fig. 2, k—m.**

Description of the type specimen, *Lörzing 8514* (L):

Frutex scandens ad 5 m altus, ramulis teretibus, junioribus pilis brevissimis laxe adpressis praeditis, adultioribus glabrescentibus vel glabris brunneis ad 3.5 mm diam. Folia petiolata, petiolis ut ramuli brevissime pilosis 1.5—2 cm longis, laminis coriaceis ovatis, apice acutiusculis vel obtusis mucronulatis, basi rotundatis, marginibus subrevolutis, 4—6 cm longis 2—3.5 cm latis, supra glabris, subtus pilis brevissimis laxe adpressis praeditis, nervo mediano et nervis lateralibus utrinque c. 7 subtus prominentibus. Inflorescentiae in axillis foliorum superiorem positae secundae, pedunculi sparse pilosi, pilis ut in ramuli, vel glabri, sulcati vel angulati, 3.5—5 cm longi, apice umbellato-cymosi multiflores; rami adpresse pilosi; pedicelli breves 2—3 mm longi apicem versus incrassati; bracteae oblongae crispatae inferiores ad 9 mm longae. Sepala glabra vel externe sparse breviterque pilosa, exteriora dua late ovata haud vel paullo crispata, apice late rotundata, marginibus inflexis, c. 7—9 mm longa; sepalum tertium latius 5—6 mm longum; sepala interiora dua c. 5—5.5 mm longa valde concava cucullata. Corolla campanulata vel infundibuliformis c. 3 cm longa violacea, limbo margine pallidiore vel albo (*Lörzing*), paullo lobato c. 4.5 cm diam. (*Lörzing*), lobis denique reflexis, fasciis mesopetalis subhirsutis, ceterum glabra. Filamenta c. 5 mm supra basin corollae inserta 15—16 mm longa, basi incrassata glabra; antherae c. 3 mm longae. Stylus filiformis; ovarium conicum 2-loculare glabrum; stigmata globosa papillosa. Discus annularis 1 mm altus. Fructus deest.

SUMATRA, East Coast, Upper Petani valley, *Lörzing 8514*, fl. Oct. 1921 (B; L, *type*). Presumably the following specimens belong here too: E. Sibajak, Petani valley, *Lörzing 9434*, young fl. Jan. 1923 (B, L); Karo upland, near Kabandjahe, *Lörzing 8731*, fr. May 1922, see remarks (B).

Distribution: Sumatra.

Habitat: moist thickets, edges of virgin forests, between 1150 and 1300 m.

Remarks: Presumably the specimens *Lörzing 9434* with young flowers and *Lörzing 8731* with fruits belong here too. The former mainly differs in its longer and more slender petioles and peduncles, in the more thinly coriaceous leaves and in the longer and narrower bracts of the inflorescences. It has the leaves long petiolate, petiole 3—6 cm, terete, the leafblade ovate to narrowly elliptic, shortly acuminate at the apex, rounded at the base or slightly attenuate into the petiole, 7—10.5 cm long, 2.5—4.5 cm broad; nerves 6—8 pairs; upper surface glabrous except for the midrib, lower one with short, stiff, slightly appressed hairs. Peduncles long, slender, 8—14 cm long, sparsely appressedly pilose. Inflorescences umbellately-cymose, many-flowered. Bracts linear, crispate, the lower ones up to 20 mm long, sparsely pilose outside, glabrous inside, pink (*Lörzing*). Sepal 1 broad-ovate or ovate-oblong, obtuse, crispate, 9—10 mm long, 6 mm broad; s. 2 ovate or ovate-oblong, obtuse, crispate, 10 mm long, 6 mm broad; s. 3 broad-ovate, flat or cucullate, 6 mm long; s. 4 and 5 deeply concave, cucullate, 5 mm long, finally deeply emarginate at the apex (always?) [1]; 2 outer sepals with some appressed hairs. *Lörzing* describes the fruits as being of a pink colour; they are, however, not represented on the sheet. *Lörzing 8731* has very young flowers and fruits and seems to be identic. In this specimen the leaves are more densely appressedly pilose beneath with short soft hairs; the upper surface is glabrous in the old, but appressedly pilose in the young leaves. Fruit ovoid, to about 15 mm long, attenuate into a mucro, at base enclosed by the sepals.

8. **Argyreia adpressa** (Wall.) Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513 — *Convolvulus adpressus* Wall., Cat. (1828) n. 1424, nomen — *Moorcroftia adpressa* (Wall.) Choisy in Mém. Soc. Phys. Genève VI (1833) p. 431; id. in DC., Prodr. IX (1845) p. 334 — *Lettsomia adpressa* (Wall.) Miq., Fl. Ned. Ind. II (1857) p. 591; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 196; Prain in Journ. As. Soc. Bengal LXIII (1894) p. 99; id. in Journ. As. Soc. Bengal LXXIV (1906) p. 324; Ridley, Fl. Malay Penins. II (1923) p. 451.

Woody climber, stems terete, brown pilose to hirsute in the young parts, later glabrescent and dark brown, up to 20 m long. Leaves petiolate, petiole hairy like the stems, 1.5—5.5 cm long; blade elliptic or elliptic-oblong, obtuse or acutish to very shortly acuminate at the apex, rounded at the base or slightly cordate, more or less densely and loosely appressed-pilose to strigillose on both sides or upper surface very sparsely strigillose, the indument more or less shining, surface of the older leaves more or less rough, 4—13 cm long and 2—8 cm broad; midrib and lateral nerves prominent beneath, lateral nerves 9—11 on each side of the midrib, parallel, straight at first, curved at the margin. Inflorescences axillary, pedunculate; peduncle hirsute, 2.5—11 cm long; flowers at the end in a dense capitate or umbelliform cyme; branches of the cyme and pedicels hairy like the peduncle; pedicels 2—3 mm long; bracts of the same form as the outer sepals, greenish white (*Lörzing*); two outer sepals linear-lanceolate, acute, 10—11 mm long, in dry specimens often with recurved apex, hirsute outside, glabrous inside or with some patent hairs; three inner sepals shorter, lanceolate, gradually attenuate towards the apex, respectively about 8, 6.5 and 5.5—6 mm long, hirsute outside, but with glabrous margins, glabrous inside. Corolla funnel-shaped, about 18 mm long, white with bright reddish purple bands, inside of throat and tube violet (*Lörzing*), the limb almost entire, the midpetaline bands with long patent hairs, forming a kind of pencil in flowerbud, for the rest glabrous; filaments inserted about 2 mm above the base of the corolla, thickened and glabrous at their base, 12—14 mm long; anthers linear, 3.5 mm long; ovary conical, 2-celled, glabrous; style filiform, 18 mm long; stigma biglobose, papillose. Fruit ellipsoid, reddish-purple (*Lörzing*), 16 × 12 mm (*Lörzing*) in dried state, at base with the irregularly spreading and reflexed sepals.

Sumatra, East Coast, above Sibolangit, rare, *Lörzing 4347*, fl. June 1916 (B, L); id., *Lörzing 4392*, fl. Aug. 1916 (B, L); id., nature reserve, not frequent, *Lörzing 5074*, fr. Apr. 1917 (B); S.W. of Sibolangit, *Lörzing 4182*, fr. Jan. 1916 (B);

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[1] Prain mentions such deeply emarginate inner sepals for *Lettsomia Curtisii* Prain in Journ. As. Soc. Beng. LXIII (1894) p. 100 (= **Argyreia Curtisii** Prain, l. c.), a species that seems to be closely related or perhaps identic.

N.W. of Sibolangit, bank of Betimoes, rare, *Lörzing 5358,* fl. Oct. 1917 (B); E. of Sibolangit, valley Lan Klewang, rare, *Lörzing 5366,* fl. and fr. Oct. 1917 (B, L); Asahan, Goerach Batoe, *Yates 1659,* fl. (B).

Distribution: Malay Peninsula, Sumatra.

Habitat: In thickets and thin forests, between 350 and 800 m.

9. **Argyreia capitata** (Vahl) Choisy in Mém. Soc. Phys. Genève VI (1833) p. 423; id. in DC., Prodr. IX (1845) p. 332; Zoll., Syst. Verz., 2. Heft (1854) p. 128; Miq., Fl. Ned. Ind. II (1857) p. 589; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 131; id. in Bull. Herb. Boiss. V (1897) p. 381; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513; Koorders, Exk. Fl. Java III (1912) p. 124; Koorders-Schum., Syst. Verz. I (1910—13), Conv. p. 7; Gagnep. & Courch. in Lec., Fl. Indo-Chine IV (1915) p. 277; Bold., Zakfl. Java (1916) n. 798 — *Convolvulus capitatus* Vahl, Symb. III (1794) p. 28 — *C. capitiformis* Poir. in Lamk., Encycl. Suppl. III (1814) p. 469 — *Ipomoea capitata* (Vahl) R. & Sch., Syst. IV (1819) p. 238 — *Lettsomia strigosa* Roxb., Fl. Ind., ed. Carey & Wall., II (1824) p. 80; Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 193; Prain in Journ. As. Soc. Bengal LXIII (1894) p. 93; S. Moore in Journ. Bot. LXIII, Suppl. (1925) p. 71 — *Ipomoea trichotosa* Blume, Bijdr. (1825) p. 717; Spanoghe in Linnaea XV (1841) p. 340 — *Convolvulus trichotosus* (Bl.) Dietr., Syn. Pl. I (1839) p. 670 — *Lettsomia capitata* Miq., Fl. Ned. Ind. II (1857) p. 591 — *Rivea capitata* Hall. f. in Meded. Rijksherb. Leiden 1 (1911) p. 26; id. in Meded. Rijksherb. Leiden 12 (1912) p. 14.

A large twiner. Stems with white milky juice, up to 10 (15?) m high, striate when dry, to 3 mm, the old woody parts to 5 mm diam., black or brown, patently brown or fulvous hirsute, occasionally appressed-pilose with softer hairs. Leaves slenderly petiolate; petiole 5—16 cm long, mostly patently hirsute; blade ovate, broad-ovate or orbicular, very rarely oblong-lanceolate (in the specimen *Cramer 117,* from Benkoelen), occasionally slightly contracted in the middle, acuminate at the apex, shallowly to deeply cordate at the base, 7.5—18 cm long, 4—13 cm broad, brown or fulvous hirsute on both sides, hairs patent to appressed; nerves 13—18 pairs, straight at the base, curved near the margin. Peduncles rather stout, terete, patently hirsute, 3—30 cm long. Flowers in a dense capitate cyme at the end of the peduncle; diam. of capitulum generally 3—7 cm, with the corollas to 12 cm, sometimes smaller in poorly developed specimens; outer bracts elliptic to elliptic-oblong, acute at both ends, 1.7—4 cm long, brown or fulvous hirsute externally and at the margins, glabrous internally except for the apical part; the upper bracts narrower, oblong to linear-oblong, to 2 cm long; pedicels very short or none. Sepals lanceolate, acuminate, the 3 outer ones 15—17 mm long, outside long hirsute, with brown patent hairs, inside glabrous except for the apical part, the 2 inner ones 12 mm long, outside hirsute, the broader base with glabrous margins, inside glabrous, except towards the top. Corolla reddish purple, pale violet or pink, often paler without and towards the base, rarely entirely white (*Galoengi 73*), funnel-shaped, 4.5—5.5 cm high, limb subentire, midpetaline bands hirsute outside. Stamens and style included. Filaments inserted c. 7—8 mm above the corolla base, shortly glandular-pilose at their bases, the corolla inside with long hairs between the places of insertion of the filaments; length of filaments about 20 mm; anthers linear, c. 5 mm long. Ovary 2-celled, cylindrical, glabrous; style glabrous, to 34 mm long; stigma biglobular, papillose. Disk low, cupular, yellowish white (*Backer*). Fruit globose, 8 mm diam., with leathery wall, orange red, reddish or brownish (*Backer, Lörzing*), 4- or less-seeded. Seeds glabrous.

SUMATRA, Atjeh and Dependencies, Takengon, *Van Steenis 5825,* fl. Aug. 1934 (B); East Coast, without exact locality, *Yates 1235* (B, L); Karo upland, near Bintang meriah, W. of Kabandjahe, *Galoengi 73,* fl. Febr. 1919, a specimen with white flowers (B); Haboko estate, *Docters van Leeuwen 3186,* fl. Febr. 1919 (B, L); Gedong djohore, S. of Medan, not rare, *Lörzing 3521,* fl. Febr. 1915 (B); Sibolangit, *Karta 58,* fl. Dec. 1928 (B, L, U); id., Botanic Garden, rather frequent, *Lörzing 4149,* fl. Dec. 1915 (B); West Coast, G. Malintang, *Bünnemeyer 4188,* fl. Aug. 1918 (B, L); id., foot, *Bünnemeyer 4441,* fl. Aug. 1918 (B, L); id., N.W. slope, *Bünnemeyer 3531,* fl. July 1918 (B); Baboei near G. Malintang, *Bünnemeyer 4135,* fl. July 1918 (B); Bt. nan Tigo, near G. Malintang, *Bünnemeyer 3759,* fl. July 1918 (B); Ophir district, Penagar, *Bünnemeyer 236,* fl. Apr. 1917 (B, L); W. slope of Talakmau, *Bünnemeyer 524a,* fl. Apr. 1917 (B); Benkoelen, Kroeï, *Cramer 117,* fl. Sept., a specimen with oblong-lanceolate leaves (B); Rimbo pengadang, *Ajoeb 382 (exped. Jacobson),* fl. June 1916 (B); Lampong Districts, Kotaboemi, *Van Heurck 8,* st. Febr. 1934 (B); Kota agoeng, *Cramer 119,* Aug. 1915 (B); id., Oeloe Beloe, *Cramer 118,* fl. Aug. 1915 (B); Kenali, Negara Batin, *Cramer 116,* fl. Aug. 1915 (B); Palembang, Martapoera, *Bal 52,* st. Jan. 1930 (B).

JAVA, without exact locality, *Horsfield s.n.* (L; U, *type* of *Lettsomia capitata* Miq.); *Korthals 255* (L); *Kuhl & Van Hasselt s.n.* (L); *De Vriese 222* (L); Bantam, G. Kentjana, *Koorders 41252β*, fl. June 1912 (B, L, U); id., *Koorders 41298β*, fl. June 1912 (B); between Tjileles and G. Kentjana, *Backer 1158,* fl. June 1911 (B); between G. Kendeng and Malingping, *Backer 1341,* fl. June 1911 (B); Batavia, G. Parang, *Blume 1233,* fl. July (L, *type* of *Ipomoea trichotosa* Bl; U); id., *Backer 13910,* fl. June 1914 (B); Buitenzorg, without exact locality, probably Sindanglaja, *Ploem s.n.* (L); Depok, *Hallier s.n.,* st. Aug. 1896 (B, L); id., *Soegandiredja 242,* st. May 1900 (B); id., *Koorders 44069 β,* fl. July 1918 (B, L); id., nature reserve, *Koorders 42633β*, st. Febr. 1914 (B); id., id., *Beumée 6058* (B); Tjipetir, *Burck & De Monchy s.n.* (B); G. Boeboet, S. of Leuwiliang, *Bakhuizen van den Brink fil. 3390,* fl. June 1924 (B); Salak, *Raap 213,* fl. June 1894 (L); Tjitjoeroeg near Tjidadap, S. of Tjibeber, *Bakhuizen van den Brink 2605,* fl. Febr. 1917 (B); Tji Sokan, E. of Tjidadap, *Backer 22383,* fl. June 1917 (B); Pelaboean Ratoe, *Boerlage s.n.* (L); id., *Koorders 34660 β,* st. Apr. 1899 (B); Priangan, Bandoeng, Dago, *Van Steenis 1652,* fl. May 1928 (B); Rawah Lakbok, S. of Tjikawoeng, *collector unknown,* fr. Aug. 1912 (B); Pekalongan, near Soebah, *Koorders 37140β*, fl. May 1899 (B); Koeripan, N. of Soebah, *Docters van Leeuwen 67,* fl. July 1911 (B); Semarang, between Soebah and Weleri, *Backer 16570,* fl. Sept. 1914 (B); forestry Manggar, near Kedoeng djati, *De Boer 4506,* fr. Oct. 1919 (B); Kramat, near Kedoeng djati, *Koorders 25014 β,* fr. Sept. 1896 (B); near Karang asem, *Koorders 28237 β,* fl. June 1897 (B, L); id., *Koorders 25014 β,* fl. Sept. 1896 (L); Salatiga, Kali Taman, *Docters van Leeuwen s.n.,* fl. July 1909 (B); Djapara-Rembang, Djapara, *Teysmann s.n.* (B); Pasokan, *Koorders 35602 β,* fl. June 1899 (B); near Ngarengan, *Koorders 35611β*, st. May 1899 (B); forestry id., *Beumée 3571,* fr. Dec. 1918 (B); Madioen, Pandan, *Elbert 477* (L); Ngebel, *Koorders 23166 β,* fl. May 1896 (B); Telogo-Ngebel, *Koorders 23183 β,* fl. May 1896 (B, L); id., *Koorders 29190 β,* fr. Aug. 1897 (B, L); Kediri, Soekaradja, *Koorders 22828β,* fl. June 1896 (B); G. Parang, *Koorders 23048 β,* fl. June 1896 (B, L); Soerabaja, foot of Welirang, *Altmann 164,* fl. Sept. 1932 (B); Malang, Djatiroto, *Backer 7889,* fl. May 1913 (B, L); Wonokerto, near Gondang legi, *Backer 3485,* fl. May 1912 (B); Bantoer, *Backer 36686,* fl. July 1927 (L); S. of Bantoer, *Backer 4002,* fl. June 1912 (B); sugar estate Alkmaar near Poerwodadi, *Mousset 877* (B); Besoeki, Poeger, *Koorders 21083 β,* fl. Oct. 1895 (B, L); id., *Koorders 21464 β,* fl. Oct. 1895 (B); N. slope of G. Idjen, near Bajeman, *Backer 25008,* fl. June 1918 (B); Djember, *Ultée 4* (B); Madoera, Ketapang daja, *Backer 21171,* fl. July 1916 (B); Kamal, *Dorgelo 655,* fl. June 1922 (L).

Cultivated specimens: *Hort. Bog. X. F. 44, Hallier C. 3. b,* fl. July 1893 (L); *Hort. Bog. XV. G. 70* (B); id., *Pulle s.n.* (U).

Distribution: Bengal, Burma, Assam, Malay Peninsula, Malay Archipelago (Sumatra, Java).

Habitat: thickets, secondary forests, edges of forests, teak woods, waysides, between 1 and 1700 m.

Vernacular names: waren mboekboek (Karobatak, Sumatra, *Galoengi*); akar boeboeloe, akasantan (Sumatra, W. coast, *Bünnemeyer*); akar boeloe (Sumatra, Palembang, *Bal*); areuj boeloe or poeloe (sund., W. Java, *Blume, Boerlage, Koorders, Miquel*); areuj boeloe beureum, areuj ki-boeloe (sund., W. Java, *Koorders*); ojod djemboeta (M. Java, *Koorders*); kotong (javan., M. Java, *Koorders*); djamet, kloerak (javan., E. Java, *Koorders*).

Use: the stems are sometimes used as binding material for bundles of firewood (Karo upland, according to Galoengi).

Remarks: The density of the hairiness in this species varies to a considerable extent; mostly the hairs are rather stiff and bristly, sometimes they are softer, more silky, and more or less appressed to the stems, petioles and surfaces of the leaves (Sumatra: *Bünnemeyer 236, 524 a, Docters van Leeuwen 3186, Van Steenis 5825, Yates 1235*; W. Java: *Backer 4319*; Madoera: *Backer 21171*). It is possible that these specimens agree with *Lettsomia peguensis* Clarke of which I could examine a specimen mentioned by Prain and represented in the Buitenzorg Herbarium. Prain (in Journ. As. Soc. Beng. LXIII (1894) p. 93) gives as his opinion that the specimen from Java upon which Miquel based his *Lettsomia capitata* (*Horsfield s. n.*) belongs to *Lettsomia peguensis* Clarke. In my opinion, however, this specimen much more agrees with materials mentioned by Clarke and by Prain as *Lettsomia strigosa.* It is for that reason that I have mentioned the synonym *L. capitata* Miq. as well as *L. strigosa* Roxb. under *Argyreia capitata.* A full account of the entangled synonymy of this species (see Prain l. c. p. 93—95) can only be given after a careful research of several types, which at present are inaccessible.

10. Argyreia Ridleyi Prain in Journ. As. Soc. Bengal LXIII (1894) p. 98, in syn. — *Lettsomia Ridleyi* Prain in Journ. As. Soc. Bengal LXIII (1894) p. 98; id. in Journ. As. Soc. Bengal LXXIV (1906) p. 324; Ridley, Fl. Malay Penins. II (1923) p. 451; Henderson in Gard. Bull. Str. Settlem. IV (1928) p. 292.

Description of the specimens from the Riouw and the Lingga Archipelago; the dimensions in parentheses refer to specimens from the Malay Peninsula.

A woody twiner. Stems terete, densely hairy with fulvous, appressed hairs, solid, up to 6 mm thick. Leaves petiolate, petiole 2.5—7(—8) cm long, hairy like the stems, the hairs directed towards the top of the petiole; blade ovate or elliptic or in the upper leaves elliptic-oblong, acuminate to cuspidate at the apex, with a narrow, acute and minutely mucronate acumen, rounded at the base, or shortly attenuate into the petiole, 10—16(—18) cm long, 5—11(—13) cm broad; upper surface glabrous or nearly so, lower surface rather densely hairy with patent or loosely appressed hairs, more densely hairy on the nerves; midrib and 6—9 nerves on each side of it prominent beneath, minor nervation reticulate, rather prominent beneath, more or less impressed above. Inflorescences axillary;

peduncles shorter than or at most as long as the petioles, stout, 1—3 (—7.5) cm long, hairy like the stems; flowers in a broad capitate 8—10-flowered (*Prain*) cyme, with large bracts; lower bracts ovate, acuminate, 2—2.5 cm long, purple (*Teysmann*) and glabrous inside, almost tomentose outside, upper bracts smaller and narrower; pedicels very short. Two exterior sepals ovate, acute, glabrous or with some hairs outside immediately below the apex, subequal, 6—7 mm long; three interior sepals elliptic or broadly elliptic, obtusish, with thin margins, c. 5.5 mm long, glabrous, sometimes with exception of the third one, which bears a few hairs near the apex. Corolla white, tinted pink (*Ridley*), c. 3 cm long, funnel-shaped with distinct tube, limb shallowly lobed, midpetaline bands hirsute outside, connecting fields glabrous. Filaments thinly filiform, inserted about 8 mm above the corolla base, c. 15 mm long, slightly dilated at their base; anthers linear-oblong, 3.5 mm long; style c. 25 mm long (description after a specimen collected by *Burkill, Singapore Field nr. 6107,* from Singapore, Mandai Road (B)). Ovary conical, glabrous, 2-celled. Disk distinct, 5-lobed, c. 1 mm high. Berry ovoid, ± 13 mm long, ± 9 mm broad, pink (*Ridley*), at base with the patent or reflexed sepals.

SUMATRA, Riouw and Dependencies, Riouw Archipelago, P. Bintan, *Teysmann s.n.,* fl. (B, L); Lingga Archipelago, B. Oewan Pelok, *Teysmann s.n.,* fl. (B, L).

Distribution: Only known from the Malay Peninsula and from the Riouw and Lingga Archipelago.

Habitat: In the Malay Peninsula local in damp forests (*Ridley*).

Remarks: The specimens from the Malay Archipelago have the leaves of var. *typica* as distinguished by Prain, l. c. p. 98. The lower bracts of these specimens are rather broadly ovate; several specimens from the Malay Peninsula have narrower, lanceolate lower bracts. Another difference between the Teysmann specimens and those from the Malay Peninsula may be found in the hairiness of the sepals. They are densely hairy externally over the whole surface or at least in the middle portion in the specimens from the Peninsula, whereas in the specimens from the islands they are glabrous except for some hairs outside, immediately below the apex.

11. Argyreia rubicunda Choisy in Mém. Soc. Phys. Genève VI (1833) p. 426; id. in DC., Prodr. IX (1845) p. 333; Miq., Fl. Ned. Ind. II (1857) p. 590; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513 — *Convolvulus rubicundus* Wall., Cat. (1828) n. 1409, nomen — *Lettsomia rubicunda* Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 195; Prain in Journ. As. Soc. Bengal LXXIV (1906) p. 326; Ridley, Fl. Malay Penins. II (1923) p. 453.

Description of the specimens from Sumatra (see remarks):

A woody climber, stems up to 5 m high, terete, up to 7 mm diam., solid, brown pubescent to tomentose, later glabrous. Leaves petiolate; petiole shortly tomentose, 2—10 cm long; blade ovate-oblong, ovate or elliptic, rounded or slightly cordate at the base, obtuse to acute at the apex, subcoriaceous, glabrous above, or with some hairs on the midrib, more or less densely appressed-pilose beneath, moderate leaves 6.5—11 cm long and 3.5—7 cm broad, large ones attaining a length of 16 cm and a width of 10 cm; nerves prominent beneath, 6—10 nerves on each side of the midrib. Peduncles long, brown pubescent to tomentose, 5—20 cm long, corymbosely ramified at the apex, many-flowered; inflorescence sometimes with 1 or few interspersed leaves of an oblong to lanceolate form; pedicels 1—4 mm, in fruit 4—10 mm long, somewhat incrassate; bracts minute, triangular to orbicular, 1—2 mm long, soon deciduous. Two outer sepals ovate-triangular, obtuse, 5 mm long, sparsely to densely appressed-pilose outside, sometimes partly glabrescent, glabrous inside; third sepal orbicular, rounded at the apex, about 6 mm long, with a membranaceous glabrous margin at one side, two inner sepals orbicular to transversely elliptic, strongly concave, about 6 mm long, appressedly pilose outside, with 2 glabrous margins, glabrous inside. Corolla deeply 5-lobed, pinkish purple (*de Voogd*), tube cylindrical, c. 6 mm long, glabrous, lobes linear-lanceolate, reflexed, glabrous inside, appressed-sericeous outside, c. 16—18 mm long, at the top with 2 small glabrous wings. Filaments dilated, thickened and provided with a large tooth inside at the glabrous base, c. 14 mm long; anthers c. 2.5—3 mm. Style filiform, stigma biglobular, papillose; ovary 2-celled; disk annular, slightly 5-lobed, c. 1 mm high. Fruit ellipsoid, c. 15 mm long, pink (*Lörzing*).

Sumatra, without exact locality, *Korthals 327 (110)*, fr. (B, L); *Forbes 2530*, fr. (L); East Coast, Hoeta Padang, near the Continental Plantation Company concession, Asahan, *Krukoff 4363*, fr. Nov.-Dec. 1932 (L); Tapanoeli, Middle Habinsaran, Aek Koewaloe, between Parsoboeran and Nassau, *Lörzing 7024*, fr. Nov. 1920 (B); West Coast, Ajer mantjoer, *Beccari 650*, fl. Aug. 1878 (L); Benkoelen, Kroeï, *De Voogd 1478*, fl. July 1932 (B, L); Soekaradja-Kenali, *Cramer 14*, fl. Aug. 1915 (B, L).

A specimen in L, according to the label collected in Java by *Van Hasselt*, and numbered *86*, most probably belongs to the *Korthals* herbarium from Sumatra. It fully agrees with the other specimens from this collector in the Leiden herbarium.

Distribution: Sumatra (Malay Peninsula, Burma?).

Habitat: in thickets, secondary and primary forests, between 360 and 800 m.

Remarks: 1. The type of *Argyreia rubicunda* Choisy is unknown to me. I identified the above-mentioned specimens with this species, on account of Hallier's identifications in the Rijksherbarium at Leiden.

2. The specimen *Forbes 2530* has been identified by Prain (in Journ. As. Soc. Bengal LXIII, 1894, p. 101) with *Lettsomia Kunstleri* Prain. It agrees, however, very well with the other fruiting specimens mentioned above as *Argyreia rubicunda* Choisy.

3. The density of the indument of the stems, leaves and inflorescences of this species appears to be rather variable. Some specimens are densely tomentose especially on the lower surface of the leaves and the inflorescences (*Beccari 650*). Less densely hairy are the leaves, but especially the inflorescences in the specimens *de Voogd 1478* and *Cramer 14*. In the former of these two numbers the sepals are partly glabrous. Still less dense is the tomentum in the *Korthals* collection.

4. The following specimens are closely related if not identic. The flowers seem to be smaller; they are, however, extremely young and for this reason a close examination of their interior parts and a comparison with those of *A. rubicunda* remains unsatisfactory.

SUMATRA, without exact locality, *Korthals 327 (122 a)*, very young fl. (B, L); West Coast, Doekoe, *Korthals 123 a*, very young fl. (L).

12. Argyreia glabra Choisy in Zoll., Syst. Verz., 2. Heft (1854) p. 128, 130; Miq., Fl. Ned. Ind. II (1857) p. 590; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513 — *Rivea glabra* (Choisy) Hall. f. in Bull. Herb. Boiss. VI (1898) p. 714.

Description of the specimens from Sumatra (see remarks):

A woody twiner. Stems terete, glabrous, dark brown and striate when dry. Leaves petiolate; petiole rather short, 1.5—4 cm long, glabrous; blade thinly coriaceous, ovate to elliptic, obtusish or acutish or very shortly acuminate at the apex, rounded or slightly retuse at the base, 6—12 cm long, 3.5—8.5 cm broad, glabrous on both sides or nearly so; midrib prominent beneath, sulcate above, lateral nerves 6—8 on each side of the midrib, not distinctly prominent. Inflorescences axillary, peduncle terete, glabrous or very shortly appressed-pilose, especially towards the apex, 3—15 cm long, umbellato-cymose, few to several-flowered; pedicels longer than the calyx, 7—9 mm long, in fruit 10—16(—18)mm, very shortly appressed-pilose; bracts at the base of the cyme linear, c. 10 mm long, the upper ones shorter. Sepals slightly unequal, sparsely appressed-pilose with very short hairs, two outer ones ovate-triangular, obtuse, c. 5 mm long, three inner ones orbicular to transverse-elliptic, the third with one, the fourth and fifth with two narrow glabrous thin margins, all c. 6—6.5 mm long. Corolla (only one not fully expanded corolla is present) c. 22 mm long, deeply 5-lobed; tube c. 5—6 mm long, lobes c. 12—13 mm long, consisting of the midpetaline band with a narrow thin glabrous wing on each side along the whole length; midpetaline band glabrous except for the apical part. Stamens inserted c. 5 mm above the corolla base; filaments filiform, dilated and sparsely pilose at their base, c. 14 mm long. Style filiform; stigma biglobular, papillose; ovary glabrous, most probably 2-celled; disk annular, subentire, c. 1 mm high. Fruit ellipsoid, c. 15 mm high, at base enclosed by the cupular calyx.

SUMATRA, without exact locality, *Korthals 114*, young fl.; *124 a*, fr.; *163 (118)* fl. (L); West Coast, Doekoe, *Korthals 121*, young fl.; *123 a*, young fl.; *171*, young fl., fr. (L); Singgalang, *Korthals 327 (113)*, fr. (L); Palembang, Moeara Enim, *Teysmann 3818 H. B.* (B, L, U).

Distribution: Sumatra, Lombok (?, see remarks).

Habitat: not mentioned on the collectors' labels.

Vernacular name: akkar dedaup ketjiel (Sumatra, Palembang, *Teysmann*).

Remarks: Hallier identified the above-mentioned specimens with *Argyreia glabra* Choisy, described from the island of Lombok. From a careful comparison of the description given by Choisy and of the plants from Sumatra, the impression is gained that there must be a great resemblance between them indeed. There are, however, a few points of difference. Choisy describes the sepals as ovate, equal and white-sericeous, whereas they are slightly unequal and sparsely appressedly pilose with very short hairs, not sericeous, in the specimens from Sumatra. Moreover the bracts (bracteoles) in the type of Choisy are presumably smaller than in the Sumatran materials. Whether both are really identic can only be decided with certainty on account of a study of the type specimen of

Choisy. Unfortunately this specimen, *Zollinger 985* from Laboean Tring, Lombok, is unknown to me and inaccessible for the time being.

13. **Argyreia erinacea** Van Ooststr., nov. spec. **Fig. 3, f—g.**

Description of the type specimen, *Clemens 30401* (B); the data in parentheses refer to the other specimen mentioned below. The description of the flower is rather fragmentary, as only one not fully developed corolla was available for examination.

Frutex scandens, ramulis teretibus (vel subangulatis), junioribus dense adpresse vel subpatente cinereo- vel fulvo-strigillosis glabrescentibus. Folia petiolata, petiolis 2.5—4(—5) cm longis leviter sulcatis, ut ramuli strigillosis, laminis ovatis vel ellipticis, apice obtusis vel brevissime acuminatis mucronulatis, basi rotundatis vel truncatis (vel subretusis), 7—11 cm longis 4.5—7 cm latis subcoriaceis, supra glabris vel pilis strigillosis nonnullis in nervo mediano et nervis lateralibus basalibus praeditis, subtus strigillosis, nervo mediano et nervis lateralibus utrinque 6—7 subtus prominentibus, nervis minoribus indistinctis. Inflorescentiae axillares, pedunculis 3—7 cm longis dense strigillosis, apice umbellato-cymosis, ramis primariis ad 1 cm longis, ramis sequentibus brevioribus 5—6 mm longis, pedicellis brevissimis 0.5—1.5 mm longis. Sepala dua exteriora late ovato-triangularia obtusa c. 4.5 mm longa, externe dense strigillosa, interne glabra; sepalum tertium orbiculare, apice rotundatum, c. 5 mm longum, externe margine uno latere excepto strigillosum, interne glabrum; sepala dua interiora orbicularia vel transverso-elliptica, apice rotundata, c. 5 mm longa, externe marginibus lateralibus latis exceptis strigillosa, interne glabra. Corolla profunde 5-lobata, tubo ? mm longo externe glabro, lobis oblongis vel probabiliter anguste ovato-oblongis ad 17 mm longis, fasciis mesopetalis externe sericeo-strigillosis, marginibus glabris. Filamenta in flore juvenili c. 13 mm longa basi incrassata glabra. Ovarium 2-loculare glabrum; stigma biglobosum papillosum; discus obscure 5-lobatus. (Bacca ellipsoidea obtusa 8—10 mm longa; semen 1).

BORNEO, British North Borneo, Mt. Kinabalu, Tenompok, *Clemens 30401*, young fl. Febr. 1932 (B, *type*); id., id., *Clemens 26635*, fr. Sept. 1931 (B).

Distribution: Borneo.

Habitat: The specimen *Clemens 30401* in the jungle at 5000 ft. elevation, the specimen *Clemens 26635*, in a forest at 4—5000 ft. elevation.

Remarks: 1. According to the collectors the stems are up to 2.5 cm diam. (breast high) and the corolla is "white with pale purple inside". The fruits are red.

2. Only one not fully developed flower was available for examination; the other flower-buds were too young.

3. The specific name *erinacea* is proposed on account of the densely strigillose or hirsute hairiness of the calyx.

14. **Argyreia cinerea** Van Ooststr., nov. spec. — *Rivea glabra* Hall. f. *var.*; Koorders in Meded. 's Lands Plantent. XIX (1898) p. 545. **Fig. 3, n—s.**

Description of the type specimen, *Sarasin 523* (L); the data in parentheses refer to the other specimens mentioned below.

Frutex scandens (15—20 m altus, *Koorders*), ramulis teretibus, junioribus dense pallide cinereo-pubescentibus vel ut petioli pedunculi et inflorescentiae brevissime tomentosis (adultioribus glabrescentibus lignescentibus). Folia petiolata, petiolis 1.5—2.5(—6) cm longis modice crassis (vel gracilibus), laminis elliptico-oblongis vel ellipticis vel late-ellipticis vel ovato-ellipticis, basi rotundatis vel in petiolos brevissime contractis (vel subcordatis), apicem obtusiusculum vel obtusum et mucronulatum versus attenuatis interdum breviter et plus minusve abrupte acuminatis 6—10(—13) cm longis 3.5—6.5(—10) cm latis, subtus praesertim in nervis pilosis, pilis brevissimis crispatis, supra adpresse pilosis, pilis strictioribus basi incrassatis, nervo mediano subtus crasso prominente, supra plano vel subsulcato, nervis lateralibus utrinque 9—11(—12), subtus prominulis dense brevissime pilosis, supra planis tenuibus, nervis minoribus reticulatis supra et subtus paullo conspicuis. Inflorescentiae axillares pedunculatae, pedunculis quam petioli valde longioribus strictis vel leviter curvatis 4.5—15 cm longis, apice umbellato-cymosis 3—5-brachiatis, pedicellis 1—2 mm longis, bracteis inferioribus oblongo-lanceolatis 7—8(—15) mm longis superioribus 2—3 mm longis. Sepala dua exteriora late ovato-triangularia vel semiorbicularia obtusa vel rotundata 2.5—3 mm longa, interiora tria orbicularia vel transverso-elliptica 2.5—3 mm longa, omnia externe dense pallide cinereo-pubescentia vel brevissime tomentosa, interne glabra; sepali tertii margo uno latere, sepalorum duorum interiorum margines duobus lateribus glabri. Corolla parva, tubo cylindrato 2.5(—3.5) mm longo glabro, limbo profunde 5-lobato, lobis oblongis c. 5.5—6 mm longis reflexis, fasciis mesopetalis externe sericeis, interne glabris, marginibus membranaceis glabris. Filamenta ad orem tubi inserta c. 2.5 mm longa, basi applanata dilatata, pilis brevissimis nonnullis praedita; antherae oblongae c. 1.5 mm longae. Ovarium 2-loculare glabrum; stylus glaber c. 4—4.5 mm longus; stigma biglobosum papillosum. Discus annulatus c. 0.75 mm altus. Bacca immatura ellipsoidea 5—7 mm longa.

CELEBES, Manado, Minahassa, near Tondano, *Forsten 51*, fl., young fr. June 1840 (B, L); Tomohon, *Sarasin 523*, fl. June 1894 (L, *type*); Ratahan, *Koorders 16579 β*, fr. March 1895 (B, L); G. Lolomboelan, near Pakoe-oerè, *Koorders 16578 β*, fl. Apr. 1895 (B).

Distribution: Northern Celebes.

Habitat: in forests on fertile volcanic soil, at 300—400 m altitude (*Koorders*).

Vernacular name: woeliliten (Manado, Tontemboan language, *Koorders*).

Remarks: Corolla white (*Sarasin*) or dirty white (*Koorders*); stigma violet (*Sarasin*); fruits reddish purple (according to the label of *Koorders 16579 β*; the fruits are, however, not extant).

15. **Argyreia micrantha** Van Ooststr., nov. spec. **Fig. 3, a—e.**

Description of the type specimen, *Clemens 29544* (L); the data in parentheses refer to the other specimens mentioned below. Only one fully expanded corolla was available for examination, the other corollas were too young or had already fallen off.

Frutex scandens ad 40 ped. altus (*Clemens*), ramulis junioribus teretibus solidis dense adpresse pallide griseo-fulvo- vel olivaceo-pilosis, pilis strictis brevissimis, vel quasi farinosis (adultioribus glabrescentibus griseis). Folia petiolata, petiolis (1.5—)2—3.5 cm longis, ut ramuli pilosis, laminis ovato-oblongis vel elliptico-oblongis, apice valde acutis vel acuto-acuminatis mucronulatis, basi rotundatis, (6—)7—12 cm longis (2—)2.5—6 cm latis chartaceis, subtus in sicco olivaceis, supra valde obscurioribus, utrinque sparse valde adpresse et breviter pilosis glabrescentibus, nervo mediano subtus prominente, supra sulcato, nervis lateralibus utrinque 7—9 tenuibus, subtus et supra paullo prominentibus, nervis minoribus inconspicuis. Inflorescentiae axillares, pedunculis strictis patento-erectis teretibus 3—12 cm longis ut ramuli adpresse brevissime pilosis, apice umbellato-cymosis 3—6-brachiatis; ramis primariis 5—16 mm longis, sequentibus brevioribus, pedicellis 2.5—5 mm longis, omnibus subangulatis vel sulcatis, ut ramuli, sed densius pilosis; bracteae desunt. Sepala aequalia c. 3 mm longa, externe breviter pilosa; dua exteriora late ovato-triangularia vel suborbicularia obtusa; sepalum tertium late triangulare vel orbiculare, apice obtusum, margine uno latere glabro; sepala dua interiora transverso-elliptica, apice late rotundata, marginibus lateralibus glabris. Corolla profunde 5-lobata, lobis plus minusve reflexis oblongis c. 8—10 mm longis, fasciis mesopetalis externe sericeo-strigillosis, interne glabris, marginibus membranaceis glabris, tubo cylindrato c. 4—5 mm longo glabro. Filamenta ad orem tubi inserta 10—11 mm longa, basi paullo dilatata glabra; antherae 2—2.5 mm longae. Ovarium 2-loculare glabrum; stylus c. 14 mm longus; stigma biglobosum papillosum; discus cupulatus 5-lobatus 1.25 mm altus, ovarium involvens. (Pedicelli et rami cymae in fructescentia reflexi; bacca late ellipsoidea obtusa c. 12 mm longa, basi sepalis persistentibus c. 5 mm longis adpressis praedita).

BORNEO, British North Borneo, Mt. Kinabalu, Tenompok, *J. & M. S. Clemens 29544*, fl. May 1932 (B; L, *type*); id., *J. & M. S. Clemens 30361*, fl. and fr. Febr. 1932 (B, L).

Distribution: Borneo.

Habitat: The type specimen in the jungle, at about 5000 feet elevation.

Remarks: According to *Clemens* (*n. 29544*) the corolla is purple and the stamens are white.

16. **Argyreia oblongifolia** Van Ooststr., nov. spec. **Fig. 2, a—e.**

Frutex scandens, ramulis junioribus teretibus brevissime adpresse cinereo-pilosis, adultioribus angulatis carinis suberosis irregularibus praeditis glabrescentibus cinereo-brunneis. Folia petiolata, petiolis 1.5—3 cm longis gracilibus, ut ramuli brevissime adpresse pilosis, laminis oblongis vel anguste oblongis, marginibus subparallelis, apicem obtusiusculum mucronulatum versus attenuatis, basi rotundatis, 5—10 cm longis 1.5—3 cm latis chartaceis vel tenuiter coriaceis, junioribus utrinque sparse adpresse et brevissime pilosis mox glabris, nervo mediano subtus prominente supra leviter impresso, nervis lateralibus 7—8 vix conspicuis, nervis minoribus inconspicuis. Inflorescentiae axillares, ut ramuli pilosae, pedunculis strictis patento-erectis 2.5—7 cm longis apice umbellato-cymosis 2—5-brachiatis, ramis primariis 3—9 mm longis, ramis sequentibus brevioribus, pedicellis 2—3 mm longis, bracteis (bracteolis) minutis 1—1.5 mm longis triangularibus, interdum foliaceis. Sepala subaequalia, externe adpresse brevissime pilosa, interne glabra, exteriora dua ovato-triangularia, interiora tria late ovato-triangularia, omnia apicem acutiusculum versus attenuata c. 3.5—4 mm longa; sepali tertii margo uno latere glaber, sepalorum duorum interiorum margines laterales glabri. Corolla infundibuliformis c. 15 mm longa profunde 5-lobata, lobis oblongo-ovatis c. 9 mm longis c. 6.5 mm latis, fasciis mesopetalis externe sericeis, marginibus tenuibus glabris, tubo c. 5—6 mm longo glabro, apicem versus dilatato. Filamenta c. 3—4 mm supra basin corollae inserta verisimiliter glabra c. 11 mm longa; antherae lanceolatae 2.25—2.5 mm longae. Ovarium glabrum 2-loculare; stylus glaber c. 14 mm longus; stigma biglobosum papillosum. Discus cupulatus obscure 5-lobatus c. 1 mm altus. Bacca ovoidea, ad 15 mm longa (matura?) cernua, basi sepalis haud vel paullo auctis c. 4 mm longis praedita.

BORNEO, South and East Division, W. Koetai, Kemoel, *Endert 4509*, fl., fr. Oct. 1925 (B).

Distribution: Borneo.

Habitat: virgin forest, at c. 1600 m altitude.

Remarks: 1. According to Endert the corolla is white and the berries are reddish.

2. This species seems to be very closely related to *A. micrantha*, from which it mainly differs in the narrower and glabrous or nearly glabrous leaves, in the form of the inner sepals and in that of the corolla. The inner sepals are transversely elliptic and broadly rounded in *A. micrantha*, in the present species they are broadly ovate-triangular and attenuate towards the acutish apex. Moreover, the corolla of *A. micrantha* has a distinct cylindric tube, whereas in *A. oblongifolia* the tube gradually widens towards the limb.

17. **Argyreia celebica** Van Ooststr., nov. spec. **Fig. 2, f—g.**

Description of the type, a fruiting specimen, *Koorders 18214 β* (L); the data in parentheses refer to the other specimens mentioned below.

Frutex scandens 15—25 m altus (*Koorders*), ramulis teretibus leviter striatis cinereo-brunneis glabris. Folia petiolata, petiolis glabris (1.5—) 2—3(—4.5) cm longis, laminis oblongo-lanceolatis vel anguste ovato-oblongis, apicem acutiusculum versus gradatim attenuatis, basi rotundatis vel breviter attenuatis, (7—)11—13(—14) cm longis (3—)4—5.5 cm latis glabris, nervo mediano subtus prominente, supra leviter impresso, nervis lateralibus utrinque 6—7 subtus et supra prominulis curvatis, nervis minoribus inconspicuis. Pedunculi stricti vel leviter curvati (2.5—)3—7(—7.5) cm longi glabri, apice 2—4 (vel ultra)-flori, pedicellis fructiferis 3—5 mm longis subangulatis vel sulcatis, apicem versus incrassatis curvatis, ergo bacca cernua. Sepala sub fructu late ovato-triangularia vel semiorbicularia aequalia c. (3—)4 mm longa, externe, interiora dua marginibus lateralibus exceptis adpresse breviter pilosa. Bacca ellipsoidea, ad 1 cm longa (matura?); semen 1 ellipsoideum.

CELEBES, Manado, Pinamoengan Mts., Kakas, *Koorders 18214 β*, fr. Jan. 1895 (B; L, *type*); bivouac Pinamorongan, near Kajoewatoe, *Koorders 19571 β*, fr. Febr. 1895 (B).

Distribution: Northern Celebes.

Habitat: in virgin forest, on fertile volcanic soil, at 500 m altitude.

Vernacular names: koenit, pahanap (Manado, *Koorders*).

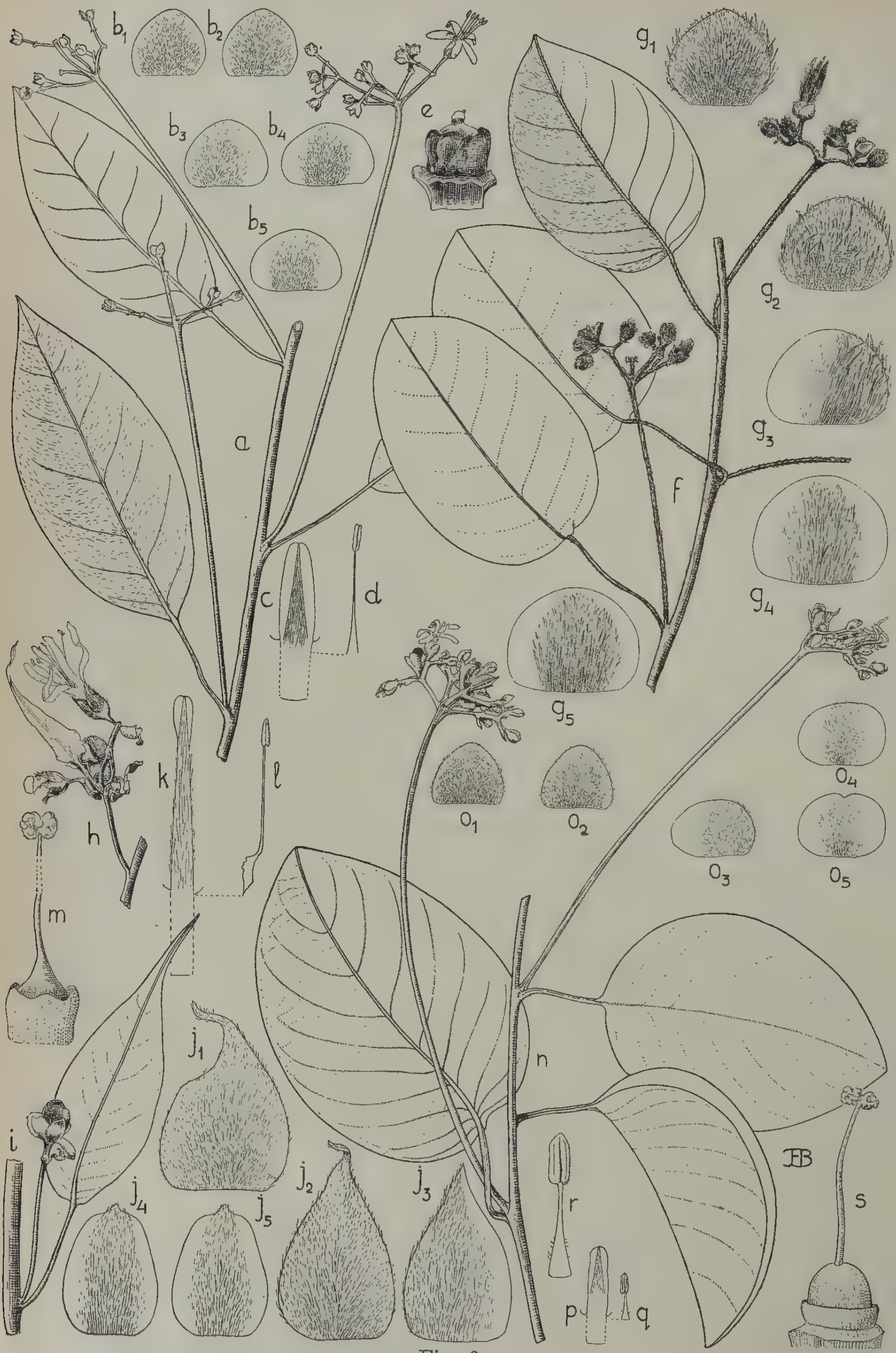
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Fig. 3.

Remarks: 1. This species seems to be closely related to *Argyreia luzonensis* (Hall. f.) Van Ooststr. [1]), from which it differs in the form and texture of the leafblades (in *A. luzonensis* mostly broader, ovate with a truncate to very slightly cordate base, and a thinner texture), with less distinct minor nervation between the lateral nerves (in *A. luzonensis* the minor nerves are distinctly reticulate), in the smaller and broader sepals (in *A. luzonensis* ovate-oblong and 5—6 mm long) and in the ellipsoid berries (in *A. luzonensis* globose), with pedicels 3—5 mm long (in *A. luzonensis* up to 8 mm long) [2]).

2. According to Koorders the fruits are purplish pink.

18. Argyreia caudata Van Ooststr., nov. spec. **Fig. 3, h—m.**

Description of the type specimen, *Amdjah 847* in the Rijksherbarium, Leiden:

Frutex scandens (ad 30 ped. altus, *Clemens*), ramulis teretibus breviter cinereo-tomentosis solidis. Folia petiolata, petiolis ut ramuli breviter tomentosis 2—5.5 cm longis, laminis anguste ovatis vel ovato-lanceolatis, basi rotundatis, apice longe lineariter caudatis, 7—10 cm longis 2—3 cm latis, subtus pilis brevibus mollibus subdense, supra rigidioribus minus dense praeditis, nervo mediano nervisque lateralibus utrinque 9—10 subtus prominentibus, nervis minoribus inconspicuis. Inflorescentiae ramulorum

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[1]) **Argyreia luzonensis** (Hall.f.) Van Ooststr., nov. comb. — *Rivea luzonensis* Hall. f. in Bull. Herb. Boiss. VI (1898) p. 714.

[2]) Another closely related species is **Argyreia pedicellata** Van Ooststr., nov. spec., from the Philippine Islands. **Fig. 2, h—j.**

Frutex scandens, partibus juvenilibus dense adpresse pilosis, mox glabris. Folia petiolata, petiolis 1.5—3.5 cm longis, laminis oblongis 5.5—8 cm longis 2—3 cm latis, apicem obtusiusculum mucronulatum versus attenuatis vel paullo acuminatis, nervo mediano nervisque lateralibus ascendentibus utrinque 5—7 subtus prominulis. Pedunculi fructiferi 4—7 cm longi; pedicelli fructiferi cernui, apicem versus gradatim incrassati, 15—22 mm longi leviter sulcati. Sepala sub fructu oblongo-triangularia obtusa c. 5—5.5 mm longa, breviter adpresse pilosa, interiora marginibus glabris. Bacca ellipsoidea ad 12 mm longa. Semen 1 ellipsoideum.

PHILIPPINE ISLANDS, Luzon, Prov. Benguet, Baguio, *Elmer 8439*, fr. March 1907 (B; L, *type*); Mindanao, Camp Keithley, Lake Lanao, *M. S. Clemens s.n.*, fr. March 1906 (B).

Distribution: Philippine Islands.

Remarks: Differs from *A. luzonensis* in the ellipsoid fruits and seeds (in *A. luzonensis* globose) with very long, 15—22 mm long, pedicels (in *A. luzonensis* up to 8 mm long). The specimen from Mindanao has broader, almost orbicular sepals.

Fig. 3. a: *Argyreia micrantha* Van Ooststr., branch of the type specimen, Clemens 29544, L; b_1—b_5: *id.*, sepals 1—5; c—d: *id.*, segment of corolla (outside) and stamen, showing place of insertion of the latter; e: *id.*, ovary with disk; f: *Argyreia erinacea* Van Ooststr., branch of the type specimen, Clemens 30401, B; g_1—g_5: *id.*, sepals 1—5; h: *Argyreia caudata* Van Ooststr., part of inflorescence of the type specimen showing elevated bract, Amdjah 847, L; i: *id.*, one-flowered fruiting peduncle with subtending leaf (bract) at its base, Amdjah 847, L; j_1—j_5: *id.*, sepals 1—5; k—l: *id.*, segment of corolla (outside) and stamen, showing place of insertion of the latter; m: *id.*, pistil with disk; n: *Argyreia cinerea* Van Ooststr., branch of the type specimen, Sarasin 523, L; o_1—o_5: *id.*, sepals 1—5; p—q: *id.*, segment of corolla (outside) and stamen, showing place of insertion of the latter; r: *id.*, stamen; s: *id.*, pistil with disk. Branches (a, f, h, i, n) ½ × nat. size; sepals (b, g, j, o) 3 × nat. size; corolla segments and stamens (c—d; k—l; p—q) 1½ × nat. size); stamen (r) 5 × nat. size; pistils and disks (e, m, s) 5 × nat. size.

apicibus approximatae, paniculam elongatam angustam formantes, inferiores axillares, superiores haud in axillis foliorum positae, sed folia (bracteae) ad pedunculos elevata vel ad ramificationes inferiores cymae inserta, pedunculis 1—6 cm longis, ut ramuli tomentosis, bracteis (bracteolis) lanceolatis vel anguste lanceolatis longe caudatis, pedicellis 4—5 mm longis subangulatis, sub fructubus incrassatis. Sepala dua exteriora late ovata vel elliptica longe et anguste acuminata 8—10 mm longa, sepalum tertium ovatum breviter acuminatum c. 7.5—9 mm longum, sepala dua interiora ovata vel elliptica obtusa sed breviter cuspidata c. 6—7 mm longa, omnia externe pilosa interne glabra. Corolla tubo glabro c. 8 mm longo, limbo profunde lobato, lobis linearibus c. 18—20 mm longis, fasciis mesopetalis externe adpresse sericeis vel strigillosis interne glabris, apicem versus alatis, alis glaberrimis. Filamenta ad orem tubi inserta c. 13 mm longa, basi incrassata verrucosa; antherae c. 2.5 mm longae. Ovarium conicum glabrum 2-loculare; stylus c. 22 mm longus; stigma biglobosum papillosum. Discus annulatus ovarium involvens 5-lobatus c. 1.5 mm altus. Fructus ellipsoideus c. 12 mm longus.

BORNEO, S. and E. Division, Pembeliangan, *Amdjah 847*, fl. and fr. Oct. 1912 (B; L, *type*); Boekit Batoe milier, *Jaheri 337 (exped. Nieuwenhuis)*, fr. (B); British North Borneo, Mt. Kinabalu, Tenompok, *Clemens 30314*, very young fl. May 1932 (B, L); Dallas, *Clemens 26064*, fl. Aug. 1931 (L).

Distribution: Borneo.

Habitat: in the jungle, at 3000—5000 ft. altitude (*Clemens*).

Remarks: 1. The flowers of *Clemens 30314* and *26064* are identic with those of *Amdjah 847*; the leaves of both specimens are, however, much broader, ovate to broadly ovate, acuminate with a long and narrow acumen, very slightly cordate at the base, up to 7.5 cm broad; they have, moreover, a much denser indument, much softer beneath than above and of a greyish to fulvous colour. The nerves of the leaves are prominent beneath and the minor nervation, consisting of parallel veins between the primary lateral nerves is more distinctly visible than in the specimen *Amdjah 847*. The petioles are up to 7 cm and the peduncles up to 8 cm long. The specimen *Jaheri 337* is a fruiting one with elliptic, obtuse and very shortly cuspidate leaves of which the largest ones are 15 cm long and 11.5 cm broad. Most probably this specimen belongs here too.

2. According to *Clemens* (*26064*) the corolla is whitish with purple; height of the plant 30 ft., diam. of stem, breast high c. 2.5 cm.

19. Argyreia aggregata (Roxb.) Choisy in Mém. Soc. Phys. Genève VI (1833) p. 427; id., in DC., Prodr. IX (1845) p. 333; Miq., Fl. Ned. Ind. II (1857) p. 591; Hall. f. in Versl. 's Lands Pl.t. 1895 (1896) p. 131 — *Lettsomia aggregata* Roxb., Fl. Ind., ed. Carey & Wall., II (1824) p. 76; id., ed. Carey, I (1832) p. 488; Wight, Icones IV (1850) t. 1359 (the capitules are much denser than in the drawing); Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 191; Cooke, Fl. Bombay II (1905) p. 259; Gamble, Fl. Pres. Madras V (1923) p. 910.

A woody climber. Stems terete, densely covered with a short, white, greyish or pale brown tomentum. Leaves petiolate, petiole 2—5 cm long, tomentose like the stems, grooved; limb ovate or broadly ovate, cordate at the base, subacute at the apex, 4—12 cm long, 4—10 cm broad, the

lower surface densely tomentose to shortly lanate, the upper surface less tomentose, darker; midrib and 7—11 pairs of lateral nerves rather prominent beneath. Peduncles angular when dry, densely tomentose like the stems, 2.5—6 cm long; flowers sessile or nearly so, in threes, crowded at the end of the peduncle in rounded capitate inflorescences; bracts broadly obovate to spathulate or orbicular, truncate, c. 8—12 mm long, densely tomentose outside, glabrous inside, subpersistent. Two exterior sepals obovate to spathulate, obtuse, 9—10 mm long; third sepal oblong, obtuse, c. 8 mm long; two interior ones oblong, obtuse, 5.5—6 mm long, all tomentose without and glabrous within. Corolla pink, tubular-campanulate, deeply 5-lobed, 12—15 mm long, the tube cylindrical, 6—7 mm long, glabrous, the lobes narrow-ovate, emarginate, c. 8 mm long, with hairy midpetaline bands and narrow glabrous margins, glabrous inside. Stamens and style exserted. Filaments inserted about 5 mm above the corolla base, dilated and hairy at their base, c. 12 mm long. Ovary 2-celled, glabrous. Disk low, annular. Fruit globose, 6—8 mm diam., red, 2—1-seeded, surrounded by the enlarged concave sepals, which are red within; seeds subglobose.

SUMATRA, Atjeh and Dependencies, Gajo Loeëus, Tjintjangdoeri, *Pringo Atmodjo 10 (exped. Van Daalen)*, fl. Febr. 1904 (B, L).

Distribution: Deccan Peninsula, Ceylon, Burma, Tenasserim, Sumatra.

Habitat: dry open places.

Remarks: Clarke, l. c. p. 192, distinguished a var. *osyrensis* of *Lettsomia aggregata* Roxb., based on *Ipomoea osyrensis* Roth, Nov. Plant. Spec. (1821) p. 117 = *Argyreia osyrensis* Choisy in DC., Prodr. IX (1845) p. 334. This var. he characterized with the words "leaves softly hairy above, white-tomentose or somewhat fuscous-villous beneath", such in contradistinction with the typical form of *L. aggregata* of which the leaves are glabrous above. According to Clarke and some other authors (Clarke, l. c. p. 192; Trimen, Handb. Fl. Ceyl. III (1895) p. 209; Gagnep. & Courch. in Lec., Fl. Indo-Chine IV (1915) p. 280; Gamble, Fl. Pres. Madras V (1923) p. 910) such specimens with hairy upper leaf surface have been found in the Deccan Peninsula and Ceylon, as well as in Indo China, Burma and Tenasserim. As far as I can trace they have not yet been discovered in the Malay Peninsula. The only specimen known from the Malay Archipelago (Northern Sumatra) has also a hairy upper leaf surface and is supposed to be identic.

The following species are unknown to me:

20. Argyreia Robinsonii (Ridley) Van Ooststr., nov. comb. — *Lettsomia Robinsonii* Ridley in Journ. Fed. Malay States Mus. VIII, 4 (1917) p. 65; Merrill in Contrib. Arn. Arb. VIII (1934) p. 145.

"Scandens, caule apresse pubescente. *Folia* lanceolata vel ovata tenuiter coriacea, basi rotundata vel obtusa apice subacuta, superne glabra subtus apresse pubescentia nervis elevatis 8 paribus 6—12 cm longa, 2.5—7.5 cm lata, petiolis 1—8 cm longa pubescentibus. *Pedunculi* 4—18 cm longi pubescentes. *Cymae laxae* multiflorae 1—4 cm longae. *Bracteae* perparvae ovatae acutae. *Pedicelli* 5 mm longi. *Sepala* oblonga truncata 4 mm longa, glabra. *Corolla* tubo brevi glabro campanulato 8 mm lobis extus sericeis intus glabris albis vel purpureis reflexis-oblongis. *Stamina* filiforma longa, longe exserta antheris oblongis. *Stylus* paullo brevior. *Stigma* capitatum" (Ridley). "Fruits purplish red" (Merrill).

SUMATRA, Atjeh and Dependencies, along the road, Takengön to Bireuen, *Bangham 840* and *1131*, Jan. and Febr. 1932 (according to *Merrill*); West Coast, Siolak Daras, *Robinson* (according to Ridley, *type*).

Distribution: Sumatra.

Habitat: Edges of and in primary forests (Merrill), alt. 3000—3300 ft. (Ridley, Merrill).

Remarks: According to Ridley this species is allied to *Lettsomia Kunstleri* (= *Argyreia Kunstleri* Prain mss.[1]), "but the calyx is quite glabrous and only the lobes of the corolla silky outside". Ridley's description of the corolla is not very detailed, but his statement that the lobes are oblong and reflexed and that the stamens are long-exserted leads one to insert *A. Robinsonii* in the group of *Argyreia* species with deeply lobed corolla. The affinity with *A. Kunstleri* is not very obvious, as the specimen of that species I could examine (*King's collector 2307*, from Larut, Perak, in the Buitenzorg herbarium) has the corolla limb only slightly lobed, and the stamens not long-exserted.

21. **Argyreia parviflora** (Ridley) Van Ooststr., nov. comb. — *Lettsomia parviflora* Ridley in Kew Bull. (1925) p. 86.

"Scandens glabra; *foliis* subcoriaceis glabris ovatis subpeltatis, acuminatis basibus rotundatis, nervis 4-paribus, 10 cm longis, 4.5 cm latis, *petiolis* 1.5 cm longis; *pedunculis* axillaribus 8—9 cm longis, *cymis* in capitulo terminali 2.5—4 cm lato, ramis 1 cm longis, pubescentibus, *bracteis* linearibus oblongis subacutis 1.5 cm longis, 3 mm latis; *sepalis* 5, 3 exterioribus ovatis rotundatis sericeo-pubescentibus coriaceis, 2 interioribus glabris paullo majoribus, omnibus roseo-marginatis, *corolla* 1 cm longa, tubo brevi, lobis 5 lanceolatis acutis coriaceis, marginibus tenuibus extus sericeis, *staminibus* 5, filamentis gracilibus basibus incrassatis corolla brevioribus, in ore tubi insertis, antheris linearibus curvis, dorsifixis, *ovario* conico canaliculato, biloculari in disco annulari lobato immerso, *stylo* gracili, *stigmate* bilobo, lobis parvis rotundatis" (Ridley).

SUMATRA, Benkoelen, Loebok Tandai, *Brooks s.n.* (Kew Herb., according to Ridley, *type*).

Distribution: Sumatra.

Habitat: unknown.

Remarks: According to Ridley this species is allied to *Lettsomia Kunstleri* Prain (*Argyreia Kunstleri* Prain), but differs by the entirely glabrous subpeltate leaves and the white capitulate small flowers. Ridley adds: "The smallest flowered species known to me, with almost completely coriaceous corolla, and with the leaves nearly peltate and very shortly bilobed at the base." As in *A. Robinsonii*, the affinity with *A. Kunstleri* is not very obvious. The specimen of *A. Kunstleri* I could examine has a corolla limb that is only slightly lobed (see remarks under *A. Robinsonii*).

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[1] **Argyreia Kunstleri** Prain mss. — *Lettsomia Kunstleri* Prain in Journ. As. Soc. Beng. LXIII (1894) p. 100.

Mentioned for the Malay Archipelago only on account of cultivated specimens:

Argyreia Kurzii (Clarke) Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513; Koorders, Exk. fl. Java III (1912) p. 124 — *Lettsomia Kurzii* Clarke in Hook., Fl. Brit. Ind. IV (1883) p. 196; originally described from Pegu; cultivated in Buitenzorg.

Doubtful for the Malay Archipelago are:

Argyreia Kunstleri Prain mss. — *Lettsomia Kunstleri* Prain in Journ. As. Soc. Bengal LXIII (1894) p. 100; id. in Journ. As. Soc. Bengal LXXIV (1906) p. 327; Ridley, Fl. Malay Penins. II (1923) p. 453; Henderson in Gard. Bull. Str. Settlem. IV (1928) p. 292.

This species has been mentioned for Sumatra by Prain, Ridley and Henderson. As far as I know, it is, however, restricted to the Malay Peninsula. The specimen *Forbes 2530* from Sumatra which Prain identified with it, most probably belongs to the species provisionally named *A. rubicunda* by the present author (see remarks under *A. rubicunda*).

Argyreia Roxburghii Choisy in Mém. Soc. Phys. Genève VI (1833) p. 419.

Miquel, Fl. Ned. Ind. II (1857) p. 586 mentions a specimen collected in the Moluccas by Reinwardt, as *Argyreia Roxburghii* Choisy. This specimen is unknown to me, but it is rather doubtful that the species occurs in the Moluccas.

Argyreia setosa Choisy in Mém. Soc. Phys. Genève VI (1833) p. 425; Decaisne, Herb. Timor. (1835) p. 61; Spanoghe in Linnaea XV (1841) p. 338; Choisy in DC. Prodr. IX (1845) p. 332; Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513.

The specimen mentioned under this name for the island of Timor probably belongs to *A. Reinwardtiana* (Bl.) Miq. *Argyreia setosa* itself occurs in British India and Ceylon.

Rivea hypocrateriformis Choisy and **R. ornata** Choisy, both mentioned for the Netherlands Indies by Boerlage (Handl. Fl. Ned. Ind. II, 1899, p. 513) do not occur in these islands.

Excluded species.

Argyreia alulata Miq., Fl. Ned. Ind. II (1857) p. 587 = **Operculina Turpethum** (L.) S. Manso, Enum. Subst. Bras. (1836) p. 16.

Argyreia sumatrana (Miq.) Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513 = **Ipomoea sumatrana** (Miq.) Van Ooststr. in Blumea III (1940) p. 571.

Lettsomia bancana Miq., Fl. Ned. Ind. Suppl. (1860) p. 561 = **Bonamia semidigyna** (Roxb.) Hall. f. var. **farinacea** Hall. f. in Versl. 's Lands Pl. tuin Buitenz. 1895 (1896) p. 125.

Lettsomia sumatrana Miq., Fl. Ned. Ind. Suppl. (1860) p. 560 = **Ipomoea sumatrana** (Miq.) Van Ooststr. in Blumea III (1940) p. 571.

Lettsomia tomentella Miq., Fl. Ned. Ind. Suppl. (1860) p. 560 = **Jacquemontia tomentella** (Miq.) Hall. f. in Versl. 's Lands Pl.tuin Buitenz. 1895 (1896) p. 126.

Corrections and Additions.

Vol. III, p. 80, line 12, for *Lettsonia*, read *Lettsomia*.
id., p. 87, line 10, for **2. P. paniculata**, read **3. P. paniculata**.
id., p. 87, line 13, for **3. P. racemosa**, read **2. P. racemosa**.
id., p. 88, line 4, add: *P. volubilis* Burm. f. var. *microcarpa* Engl. in Engl., Bot. Jahrb. VII (1886) p. 472.
id., p. 270, line 2, add: *Convolvulus parviflorus* Vahl var. *Neumanni* Engl. in Engl., Bot. Jahrb. VII (1886) p. 472.
id., p. 292, line 5, for Dennst. ex Hall. f., read Dennst. ex Hall. f. emend.
id., p. 308, line 19, for *Convolvulus hibridus*, read *Convolvulus hybridus*.
id., p. 483, line 17 from bottom, for Klotsch, read Klotzsch.
id., p. 502, line 16, for Sept. 115, read Sept. 1915.
id., p. 502, line 19, for Strickland River, read Strickland River, *Baeuerlen*.
id., p. 560, line 17 from bottom, after XV. K. B. XII. 6, add: var. *fol. variegatis* Hall. f.
id., p. 561, line 4 from bottom, after XV. H. 5 and 5 A, add: and XV. K. B. XII. 6.
id., p. 570, line 7 from bottom, for as far as south, read as far south.
id., p. 571, line 14, add: ? *Argyreia sumatrana* Boerl., Handl. Fl. Ned. Ind. II (1899) p. 513.
id., p. 575, line 8 from bottom, for *Ipomoea grandiflora* (Choisy) Hall. f., read *Ipomoea grandiflora* (Jacq.) Hall. f.
Vol. V, p. 360, between line 4 and 5, add: Use: See Heyne, l. c. p. 1307.

Indices to parts I—IV.

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Van Ooststroom 4062*): XVI, 18 — Baeuerlen *s.n.*: XIII, 20 — Bakhuizen van den Brink *59*: IV, 1; *876*: XX, 1; *1153*: XIII, 12; *1387*: XVI, 30; *1432*: XVI, 19, (1); *1465*: XVI, 14; *1475*: XX, 1; *2042*: XVIII, 1; *2102*: XX, 1; *2359*: XIII, 12; *2605*: XX, 9; *2876*: XIII, 12; *3255*: XVI, 30; *3665*: I, 1; *3800*: XIII, 3; *3835*: XIII, 2; *4054*: XIII, 11; *4195*: XIII, 20; *4278*: XVIII, 1; *4313*: XVIII, 1; *4349*: XVIII, 1; *4812*: XIII, 12; *5446*: XII, 1; *5484*: XIII, 3; *5745*: XVI, 10; *6366*: XIII, 3; *6798*: XIII, 2; *7815*: XIII, 20; *7850*: XIII, 8; *7879*: XVI, 27 — Bakhuizen van den Brink fil. *14*: XVI, 10; *35*: XVI, 10; *136*: XVI, 30; *356*: XVI, 10; *395*: VI, 3; *443*: XIII, 2; *770*: IV, 1; *1442*: XIII, 2; *1505*: XIII, 3; *1622*: IV, 1; *1653*: XVI, 10; *1661*: XVI, 14; *1772*: XVI, 30; *1942*: XIII, 1; *2112*: XII, 1; *2174*: XVI, 14; *2258*: XIII, 1; *2447*: XVI, 27; *2702*: XVI, 31; *3236*: XVI, 33; *3390*: XX, 9; *3453*: XIII, 1; *3587*: XVI, 8; *3677*: XIII, 6, (2) — Bal *29*: XIII, 12; *51*: XIII, 12; *52*: XX, 9 — Balansa *3539*: VIII, 1, var. grandiflora — Bangham *657*: VI, 1; *840*: XX, 20; *1131*: XX, 20 — Barbey *396*: XIII, 12 — Barthe *s.n.*: XII, 1 — Beccari *650*: XX, 11; *665* (Borneo): XIII, 20; *665* (Sumatra): XVIII, 1; *720*: XIII, 12; *836*: XIII, 6, (2); *2761*: VIII, 3, (3); *3053*: IV, 1; *3594*: XIII, 17; *3955*: XIII, 21, (1) — Beguin *162*: XVI, 3; *164*: XVI, 17; *165*: XVI, 8; *627*: XIII, 20; *809*: XVI, 14; *901*: XVI, 8; *911*: XVI, 19, (1); *920*: XVI, 6; *992*: XIII, 6, (2); *1075*: XVI, 13; *1115*: XIII, 12; *1150*: XIV, 1; *1551*: XIV, 1; *1603*: XII, 1; *1605*: XIII, 7; *1610*: XIII, 2; *1620*: XIII, 11; *1655*: XVI, 39; *1745*: XVI, 13; *2032*: XVI, 6; *D 4*: VI, 1; *E 4*: XX, 1; *J 3*: VI, 1; *L 2*: VIII, 1; *Q 2*: VI, 1; *V 3*: XX, 1; *W 2*: XVI, 14 — Bell & Haniff *s.n.*: V, 1 — Den Berger *412*: XIII, 12; *476*: XIII, 1 — Berkhout *503*: XVI, 13 — Beumée *660*: XIII, 11; *661*: XIII, 6, (2); *716*: XIII, 11; *849*: VI, 1; *880*: VIII, 1; *915*: VI, 1; *973*: XX, 1; *988*: VI, 1; *991*: XIII, 1; *999*: XIII, 11; *1006*: VIII, 1; *1582*: XVI, 8; *1756*: XX, 1; *1882*: XX, 1; *2244*: XX, 1; *2385*: XVI, 11; *2494*: VIII, 1; *2642*: XX, 1; *2683*: XVI, 38; *2705*: VIII, 1; *3429*: XVI, 36; *3571*: XX, 9; *3642*: XVI, 19, (1); *4168*: XVI, 11; *4252*: XVIII, 1; *4309*: VIII, 1; *4311*: XII, 1; *4378*: XIII, 11; *4387*: XIII, 12; *4392*: XVI, 14; *4480*: VI, 1; *4498*: XIII, 12; *4553*: XIII, 12; *4961*: XVI, 31; *5103*: XVI, 8; *5134*: XX, 1; *5187*: VI, 1; *5232*: XIII, 1; *5252*: VIII, 1; *5288*: VIII, 1; *5341*: XIII, 11; *5452*: XII, 1; *5528*: VI, 1; *6011*: XX, 1; *6058*: XX, 9; *6068*: XVIII, 1; *A. 68*: XVI, 19, (1); *A. 90*: XVI, 19, (1); *A. 182*: XVI, 19, (1); *A. 238*: XVI, 19, (1); *A. 630*: I, 4; *A. 876*: XVI, 3; *A. 922*: XII, 1; *s.n.*: XIII, 1 — Bijhouwer *37*: XIII, 11; *76*: XIII, 1; *77*: XIII, 11; *141*: XVI, 17; *209*: XVIII, 1; *229*: XVI, 19, (1) — Bik *s.n.*: XIV, 1 — Binnendijk *s.n.*: III, 1 — Blokhuis *s.n.*: VIII, 1; XII, 1; XIII, 1; XVI, 14; XX, 1 — Blume *42*: XIII, 12; *59*: XII, 1; *61*: XVI, 19, (1); *77*: XVI, 18; *88*: XVI, 17; *98 (?)*: VI, 1; *684*: XVI, 38; *1002*: XII, 1; *1075*: XVI, 18; *1097*: XVI, 34; *1113*: IX, 1; *1123*: XIII, 1; *1135*: XVI, 17; *1169*: VIII, 1; *1219*: XIV, 1; *1220*: XIII, 11; *1233*: XX, 9; *1234*: XVI, 38; XVIII, 1; *1505*: XIII, 20; *1562*: XVI, 27; *1685*: XVI, 19, (1); *1710*: XVI, 13; *s.n.*: III, 1; IV, 1; VI, 2; VIII, 1; IX, 1; XII, 1; XIII, 11; XIII, 20; XVI, 39; XVIII, 1; XX, 1 — Boedijn *1248 A*: XVI, 35; *2089*: XVI, 19, (1); *2509 A*: XIV, 1; *s.n.* (*herb. Van Steenis 3060*): XX, 1 — De Boer *2*: XX, 1; *18*: XIII, 1; *28*: VIII, 1; *4506*: XX, 9 — De Boer, Forestry Experiment Station *B. B. 3642*: XVI, 19, (1) — Boerlage *11*: XVI, 19, (1); *28*: XVI, 19, (1); *32*: XVI, 19, (1); *94*: XIII, 6, (2); *99*: XVI, 12; *110*: XIII, 12; *138*: XVI, 18; *304*: XVI, 14; *353*: XIII, 12; *482*: III, 1; *512*: XIII, 12; *551*: XVI, 8; *558*: XIII, 12; *565*: XVI, 6; *567*: XIII, 2; *678*: III, 1; *s.n.*: IV, 1; VI, 2; VIII, 1; XIII, 3; XIII, 6, (2); XIII, 11; XIII, 12; XIII, 20; XVI, 6; XVI, 14; XVI, 19, (1); XVI, 27; XVI, 30; XVI, 39; XVIII, 1; XX, 9 — Bon *2700*: Merremia Bimbim; *4801*: XIII, 13, (1) — Booberg *s.n.*: XIII, 6, (2); XVI, 13 — Boorsma *s.n.*: VI, 1 — Boschma *4*: XVI, 12; *14*: XVI, 19, (1); *68*: XVI, 39; *75*: XVI, 13; *131*: XVI, 19, (1); *155*: XVI, 19, (1); *210*: XVI, 12; *230*: XVI, 19, (1); *231*: XVI, 19, (1); *252*: XVI, 8; *282*: XVI, 19, (1); *311*: XVI, 12 — Mrs. Bouman—Houtman *7*: VI, 1; *72*: XVI, 17; *96*: XVI, 14; *100*: VI, 1; *132*: XVI, 40; *133*: XVI, 38, (1); Bovien, herb. Djombang *4*: XIII, 1; *43*: XVI, 36; *67*: XIII, 1 — Branderhorst *69*: XVI, 13; *158*: XIII, 20 — Brass *6231*: XVI, 19, (1); *6241*: XVI, 31; *6446*: XVI, 35; *6565*: XVI, 26; *7290*: XVIII, 2; *7437*: XVI, 32; *7443*: XIII, 2; *7543*: XIII, 3; *7578*: XIII, 1, (1); *7612*: XVIII, 2; *7646*: XIII, 1, (1); *7651*: IX, 1; *7719*: XIV, 3; *7720*: XIII, 12; *7729*: XIII, 12; *7778*: XIII, 1, (1); *7836*: XIII, 3; *8191*: XIII, 20; *8196*: XVI, 13; *8317*: XIV, 1 — Bremekamp *8309*: XIII, 6, (2); *s.n.*: III, 1; VI, 2; XIII, 6, (2); XIII, 11 — Brinkman *60*: XVI, 8; *92*: XVI, 31; *302*: XVIII, 1; *353*: XIII, 5; *476*: VI, 1; *494*: XX, 1; *531*: XII, 1; *537*: XVI, 14; *606*: XVI, 6; *643*: VIII, 5; *801*: VI, 2 — Brooks *s.n.*: XX, 21 — Brown *s.n.*: XII, 1; XIV, 2; XVI, 5 — Bruggeman & Hagen *904*: XVI, 13 — Buitendijk *s.n.*: VIII, 1 — Bünnemeyer *72*: XIII, 12; *87*: XVI, 18; *135*: XIII, 12; *194*: XIII, 20; *207*: XIII, 11; *236*: XX, 9; *238*: XIII, 12; *261*: XIII, 6, (2); *306*: XIII, 11; *314*: XVIII, 1; *319*: XIII, 6, (2); *336, 337*: XIII, 12; *345*: XIII, 20; *524a*: XX, 9; *1076*: XVI, 12; *1243*: XIII, 6, (2); *1408*: XIII, 6, (2); *1468*: XIII, 6, (1); *1541*: XVI, 13; *1545*: XVI, 19, (1); *1562*: XIII, 6, (1); *1618*: XIII, 6, (2); *1620*: XVI, 12; *1710*: XVI, 9; *1868*: XIII, 6, (2); *1927*: XIII, 6, (2); *1938*: XVI, 13; *2237*: XIII, 12; *2368*: XVI, 13; *2478*: XVI, 19, (1); *3010*: XVI, 5; *3505*: XIII, 12; *3531*: XX, 9; *3758*: XIII, 6, (2); *3759*: XX, 9; *4135*: XX, 9; *4188*: XX, 9; *4420*: XIII, 6, (2); *4441*: XX, 9; *4450*: XII, 1; *4457*: XVI, 14; *4814*: XVI, 5; *5179*: XVI, 6; *5793*: XVI, 8; *5843, 5844*: XVI, 13; *6240*: XIII, 6, (2); *6294*: XVI, 13; *6350*: XIII, 6, (2); *6402*: XVI, 19, (1); *6417*: XVI, 31; *6440*: XVI, 31; *6448*: XIII, 6, (1); *6864*: XVI, 18; *7169*: XVI, 36; *7312*: XVI, 13; *7408*: XIII, 6, (2); *7481*: XVI, 19, (1); *7624a*: XVI, 31; *7743*: XVI, 18; *7998*: XIII, 12; *8054*: XIII, 12; *8100*: XVIII, 1; *8302*: XIII, 12; *8305*: XVI, 5; *8364*: XIII, 6, (2); *10579*: XIII, 6, (2); *10588*: XVI, 8; *10625*: XVI, 30; *10628*: XIII, 6, (2); *10662*: XIII, 6, (2); *10663*: XII, 1; *10692*: XIII, 3; *10717*: XVI, 27; *10760*: XVI, 8;

10761: XIII, 6, (2); *10763*: XVI, 5; *10871*: XIII, 6, (2); *11148*: XIII, 11; *11150*: XII, 1; *11151*: XIII, 6, (2); *11181*: XVI, 5; *11182*: XVI, 27; *11279*: XIII, 11; *11289*: XII, 1; *11303*: XVI, 5; *11365*: XIII, 11; *11394*: XIII, 6, (2); *11435*: XVI, 14; *11436*: XIII, 11; *11494*: XVI, 5; *11495*: XVI, 1; XVI, 5; *11499*: XVI, 8; *11551*: XVI, 27; *11553*: XVI, 8; *11554*: XVI, 7; *11559*: XIII, 12; *11730*: VI, 2; *11741*: XVI, 14; *11744*: XIII, 11; *11745*: XVI, 5; *11759*: XVI, 27; *11789*: XIII, 11; *12269*: XVI, 12; *12444*: XVI, 14; *12476*: XIII, 12; *12477*: XIII, 11; *12525*: XVI, 5; *12538*: XIII, 6, (2) — Burck *156*: VI, 2; *182*: XVI, 6; *369*: XX, 1 — Burck & De Monchy *s.n.*: XII, 1; XX, 1; XX, 9 — Bureau of Science (Philippines) *256 bis* (*Villamil*): XVI, 36; *265*: XIII, 20; *298* (*Bermejos*): XIV, 1; *430* (*Mangubat*): XVI, 13; *436* (*Mangubat*): XIV, 1; *445* (*Ramos*): XVI, 27; *483* (*Mangubat*): XIII, 11; *707* (*Ramos*): XVIII, 1, (2); *762* (*Merrill*): XIII, 3; *1261* (*Merrill*): XVI, 14; *1337* (*Mangubat*): XVI, 8; *1432* (*Merrill*): XVI, 23; *1600* (*Ramos*): VIII, 1; *1702* (*Mc Gregor*): XVI, 30; *1953* (*Ramos*): XVI, 29; *1965* (*Ramos*): XVI, 14; *1966* (*Ramos*): XVI, 8; *1971* (*Topping*): XIII, 22; *1988* (*Ramos*): XIII, 1; *2028* (*Ramos*): XVI, 35; *2060* (*Ramos*): XVI, 8; *2078* (*Ramos*): XIV, 3; *2796* (*Ramos*): XIV, 3; *4835* (*Ramos*): XIII, 2; *5168* (*Merrill*): XVI, 18; *5173* (*Merrill*): XII, 1; *5339* (*Ramos*): VI, 1; *7045* (*Ramos*): XIV, 1; *7246* (*Ramos*): VI, 1; *7248* (*Ramos*): XVI, 5; *7342* (*Celestino*): XIII, 22; *7474* (*Ramos*): XVI, 13; *7758* (*Gates & Otanes*): XVI, 34; *9305* (*Merrill*): XVI, 13; *6919* (*Robinson*): XIII, 5; *9658* (*Robinson*): XIV, 3; *9717*: (*Robinson*): XIII, 11; *10910* (*Ramos*): XVI, 27; *11041* (*Ramos*): XIII, 2; *11103* (*Ramos*): XIV, 3; *11151* (*Mc Gregor*): XVI, 27; *11328* (*Mc Gregor*): XVIII, 1, (2); *11341* (*Mc Gregor*): XIII, 6, (2); *11394* (*Mc Gregor*): XII, 1; *11398* (*Mc Gregor*): XIII, 12; *11399* (*Mc Gregor*): XIII, 6, (2); *11439* (*Mc Gregor*): XIII, 1; *11623* (*Robinson*): XVI, 30; *11714* (*Robinson*): XVI, 10; *12149* (*Ramos*): XVI, 31; *12196* (*Ramos*): XVI, 5; *12381* (*Mc Gregor*): XVI, 27; *12385* (*Mc Gregor*): XIX, 1; *12397* (*Mc Gregor*): XVI, 38, (1); *12676* (*Fénix*): XVIII, 1, (2); *12678* (*Fénix*): XIII, 6, (2); *12769* (*Fénix*): XII, 1; *12952* (*Fénix*): VI, 1; *13292* (*Ramos*): XIII, 22; *13307* (*Ramos*): XIII, 20; *13589* (*Ramos*): XIII, 6, (2); *14498* (*Ramos*): XII, 1; *14578* (*Ramos*): XIII, 3; *14665* (*Ramos*): XIII, 20; *17273* (*Robinson & Foxworthy*): XIII, 20; *17364* (*Robinson*): XIV, 1; *19178* (*Reillo*): XVI, 29; *22419* (*Gates & Otanes*): XVI, 34; *22467* (*Ramos*): XIII, 11; *22470* (*Ramos*): XIV, 3; *24088* (*Ramos*): XIII, 2; *26073* (*Fénix*): XIII, 6, (2); *27181* (*Ramos*): VIII, 1, (2); *27214* (*Ramos*): XIX, 1; *27412* (*Ramos*): XIV, 1; *27601* (*Ramos*): XVI, 13; *27605* (*Ramos*): XII, 1; *27606* (*Ramos*): XIII, 1; *27614* (*Ramos*): XIX, 1; *32333* (*Mc Gregor*): XVI, 8; *34758* (*Ramos & Pasgasio*): XIII, 22; *41406* (*Mc Gregor*): XIII, 2; *44196* (*Ramos & Edaño*): XIII, 6, (2); *44603* (*Ramos & Edaño*): VIII, 1; *44610* (*Ramos & Edaño*): XIII, 3; *46901* (*Ramos & Edaño*): XIII, 12 — Bureau of Science (Sarawak) *1975* (*Native collector*): XIII, 3 — Burkill *3072*: XIII, 12; *3075*: IV, 1; *s.n.*: XIII, 6, (2); XIII, 20 — Burkill & Haniff *938*: V, 2, (1); *15681*: IV, 1; *15701*: XIII, 20 — Burman *s.n.*: XIII, 1; XIII, 2 — Büsgen *62*: XVI, 14 — Buysman *13*: VI, 2; *174*: VIII, 1; *205*: XIII, 12; *206*: XIII, 20; *207*: XVI, 10; *208*: XVI, 19, (1); *209*: XIII, 12; *210*: XIII, 11; *328*: XVI, 6; *439*: XVI, 30; *2913*: XIII, 6, (2); *s.n.*: VI, 2; XVI, 12; XVI, 14; XVI, 27; XVI, 29.

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Koedoes *1128*: XVI, 10 — Koens *21*: XVI, 14; *164*: XVI, 10; *241*: XVI, 14; *261*: VI, 2; *452*: VI, 2; *514*: XVI, 18; *s.n.*: XVIII, 1 — Kooper *802*: XIII, 12; *910*: XVI, 10; Koorders (the β behind the number has been omitted) *134*: XVI, 19, (1); *242*: XVI, 19, (1); *15031*: XIII, 12; *15279*: XX, 1; *16544*: XIII, 12; *16545*: XIII, 12; *16546*: XIII, 12; *16547*: XIII, 12; *16548*: XIII, 12; *16549*: XIII, 12; *16550*: XIII, 6, (2); *16551*: XIII, 6, (2); *16552*: XIII, 6, (2); *16553*: XIII, 1; *16554*: XIII, 1; *16555*: XIII, 1; *16556*: XIII, 1; *16557*: XII, 1; *16558*: IX, 1; *16559*: IV, 1, (1); *16560*: XVI, 13; *16561*: XVI, 13; *16562*: XVI, 18; *16563*: XVI, 6; *16564*: XVIII, 1, (2); *16565*: XIII, 20; *16566*: XIII, 20; *16567*: XIII, 20; *16568*: XIII, 20; *16569*: XIII, 20; *16570*: XIII, 20; *16571, 16572, 16573*: XVI, 19, (1); *16574*: XVI, 12; *16575*: XVI, 13; *16576*: XVI, 13; *16577*: XIV, 1; *16578, 16579*: XX, 14; *16580*: XVI, 27; *16581*: XVI, 35; *16582*: XVI, 31; *16583*: XVI, 31; *16584*: XVI, 31; *16585*: XVI, 12; *16586*: XVI, 19, (1); *18214*: XX, 17; *19571*: XX, 17; *19869*: VI, 2; *20868*: XVI, 18; *20925*: XII, 1; *20930*: XIII, 12; *21018*: XIII, 6, (2); *21022*: XII, 1; *21069*: XIII, 11; *21070*: XVI, 14; *21071*: XVI, 14; *21072*: XX, 1; *21073, 21074*: XX, 1; *21075*: XVI, 30; *21076*: XVI, 34; *21077*: XIII, 11; *21078*: XIII, 11; *21079*: XIII, 1; *21080*: XIII, 12; *21081*: XX, 1; *21082*: XII, 1; *21083*: XX, 9; *21085*: VIII, 1; *21128*: XIII, 11; *21329*: VI, 1; *21457*: XIII, 12; *21463*: VIII, 1; *21464*: XX, 9; *22250*: VI, 2; *22445*: VI, 1; *22515*: XVI, 8; *22828*: XX, 9; *22836*: XVI, 7; *22859*: XVI, 30; *22861*: XVI, 38, (1); *22874*: XVIII, 1; *22891*: XII, 1; *22967*: XVIII, 1; *22990*: VI, 1; *22994*: XIII, 6, (2); *23048*: XX, 9; *23164*: XVI, 1; *23166*: XX, 9; *23169*: XVIII, 1; *23181*: XVI, 27; *23183*: XX, 9; *23200*: XVI, 5; *23236*: XVI, 29; *23364*: XIII, 1; *23380*: XIII, 20; *23449*: XVI, 18; *23464*: XVI, 38; *23694*: XIII, 20; *23808*: XX, 1; *23900*: XX, 1; *23906*: VI, 2; *23997*: VI, 2; *23999*: XVIII, 1; *24178*: XIII, 20; *24506*: XIII, 1; *24507*: XIII, 11; *24530*: XIII, 11; *24875*: XIV, 1; *24899*: XII, 1; *25014*: XX, 9; *25044*: XIII, 11; *25054*: XIII, 12; *25057*: XIII, 11; *25207*: VIII, 1; *25354*: VIII, 1; *27051*: XVI, 19, (1); *27051*: XVI, 35; *27179*: XIII, 6, (2); *27336*: XVI, 8; *27337*: XVI, 19, (1); *27338*: XII, 1; *27339*: XVI, 8; *27603*: VI, 1; *27604*: VI, 1; *27706*: XVIII, 1; *27707*: XX, 1; *27708*: VI, 2; *28092*: XX, 1; *28093*: XIII, 12; *28094*: VIII, 1; *28174*: XVI, 29; *28231*: XX, 1; *28232*: VIII, 1; *23233*: XX, 1; *28234*: XVI, 14; *28235*: XVI, 8; *28236*: XIII, 1; *28237*: XX, 9; *28238*: XIII, 1; *28462*: XIII, 3; *28509*: XIII, 11; *28510*: XVI, 14; *28702*: VI, 2; *28705*: VI, 2; *28756*: XIII, 11; *28893*: XVI, 19, (1); *29190*: XX, 9; *29191*: XX, 1; *29192*: XVI, 14; *29193*: XIII, 11; *29468*: VI, 2; *29475*: VI, 2; *29684*: XVI, 19, (1); *29874*: XIII, 6, (2); *29954*: XVI, 30; *29995*: XVI, 8; *31153*: XIII, 12, prob. (1); *31154*: XIII, 12; *31155*: XIII, 20; *32263*: VI, 2; *32403*: XIII, 6, (2); *32408*: XIII, 11; *32411*: XIII, 12; *32604*: XIII, 5; *32620*: XVI, 10; *32916*: XIII, 1; *32921*: XVI, 19, (1); *33504*: XIII, 6, (2); *33505*: XII, 1; *33506*: XII, 1; *33507*: XVI, 30; *33508*: VIII, 1; *33509*: XIII, 6, (2); *33510*: XIII, 11; *33511*: VIII, 1; *33512*: XVI, 8; *33513*: XX, 1; *33514*: VIII, 1; *34039*: XVIII, 1; *34659*: XVI, 19, (1); *34660*: XX, 9; *34661, 34662*: XIII, 20; *34663*: XII, 1; *34664*: IV, 1; *34665*: XIII, 3; *34666*: XIII, 6, (2); *34667*: XIII, 12; *34671*: XIII, 11; *34860*: XIII, 5; *35116*: XVI, 12; *35420*: XVI, 12; *35517*: XVI, 8; *35565*: XVI, 30; *35598*: XVI, 19, (1); *35599*: XX, 1; *35600*: XVI, 12; *35602*: XX, 9; *35603*:

XIII, 6, (2); *35604*: XVI, 38; *35605*: XVI, 14; *35606*: XVI, 18; *35607*: XIV, 1; *35608*: XIII, 1; *35609*: XVI, 8; *35610*: XII, 1; *35611*: XX, 9; *35612*: XIII, 12; *35613*: XII, 1; *35619*: XIII, 12; *35683*: XVI, 12; *35783*: XVI, 12; *35785*: XVI, 1; *35786*: VI, 2; *35787*: XVI, 12; *35788*: XX, 1; *36224*: XVI, 18; *36225*: XVI, 34; *36226*: XVI, 18; *36841*: XVI, 40; *36856*: VI, 1; *36861*: XIII, 11; *36864*: XIII, 12; *36903*: XIII, 6, (2); *36979*: XIII, 1; *36989*: XVI, 8; *36997*: VIII, 1; *37004*: XIII, 1; *37140*: XX, 9; *37381*: I, 4; *38075*: XVI, 12; *38077*: XVI, 12; *40182*: XVI, 31; *40296*: XIII, 14; *40565*: XVI, 18; *40632*: XIII, 6, (2); *40682*: XVIII, 1; *40724*: XVIII, 1; *40725*: XVIII, 1; *40789*: XIII, 12; *40793*: IV, 1; *40823*: XVI, 18; *40926*: XIII, 12; *41117*: XIII, 6, (2); *41118*: XIII, 20; *41205*: XIII, 12; *41252*: XX, 9; *41298*: XX, 9; *41375*: XVIII, 1; *41401*: XIII, 12; *41424*: XVIII, 1; *41514*: XIII, 3; *41560*: IV, 1; *41735*: XVI, 5; *42175*: XVI, 36; *42176*: XVI, 6; *42179*: XVI, 23; *42180*: XVI, 6; *42181*: XVI, 6; *42502*: VI, 2; *42555*: XIII, 20; *42633*: XX, 9; *42676*: XVI, 23; *43184*: XIII, 11; *43185*: I, 4; *43186*: VI, 2; *43693*: XVI, 14; *43882*: VIII, 1; *43988*: XVIII, 1; *44005*: XIII, 12; *44053*: XIII, 14; *44068*: XIII, 20; *44069*: XX, 9; *44070*: XX, 1; *44072*: XIII, 12; *44151*: XIII, 20; *44309*: XX, 1; *47913*: XIII, 6, (2); *47914, 47915*: XVI, 6; *47916*: XVI, 27; *47917*: XIII, 12; *47918*: XX, 1; *s.n.*: XIII, 6, (2) — Kornassi *5*: XVI, 14; *191*: XVI, 19, (1); *575*: XVI, 27; *576*: XVIII, 2; *634*: XVI, 36; *754*: XIII, 6, (2); *783*: XVI, 19, (1); *875*: XVI, 32; *896*: XIII, 6, (2); *978*: XVI, 31; *1016*: XIII, 20; *1096*: III, 1; *1141*: XIII, 12; *1183*: XIII, 20; *1197*: XIII, 12; *1256*: XVI, 35; *1263*: XVI, 18; *1274*: IV, 1, (1); *1288*: XVI, 8; *1306*: XIII, 3; *1309*: XIII, 12; *1324*: XVIII, 2; *1338*: XIX, 1; *1347*: XVI, 31; *1404*: XVIII, 2 — Korthals *48*: IV, 1; *49*: VI, 1; *52*: XIII, 6, (2); *85*: IX, 1; *87*: IX, 1; *93*: XVIII, 1; *100*: XVI, 8; *102*: XIII, 6, (2); *104*: XVI, 31; *108*: XIII, 5; *109*: XVIII, 1; *111, 112*: XVI, 31; *114*: XX, 12; *117*: VI, 2; *119*: XVI, 27; *120*: XIII, 2; *121*: XX, 12; *122*: XIII, 6, (2); *123 a*: cf. XX, 11; XX, 12; *124*: XIII, 6, (2); *124 a*: XX, 12; *125*: VI, 2; *126*: XVI, 34; *127*: XIII, 6, (2); *128*: XVI, 8; *129*: XVI, 8; *131 (34)*: XVI, 1; *132*: VIII, 1; *134*: VI, 2; *160*: VI, 1; *161*: VI, 1; *163 (118)*: XX, 12; *170*: IV, 1; *171*: XX, 12; *173*: XVI, 31; *174*: XIII, 6, (2); *179*: XVI, 8; *185*: XIII, 6, (2); *186*: XVIII, 1, (1); *207*: XIII, 6, (2); *225*: XIII, 3; *226*: IV, 1; *227*: XVIII, 1; *228*: XVIII, 1, (1); *230*: XIII, 12; *231*: XIII, 1; *232*: XIII, 12; *233*: XIII, 12; *234*: XII, 1; *235*: XVI, 27; *236*: XVI, 14; *237*: XIII, 19; *238*: XVI, 34; *239*: XVI, 31; *240*: XVI, 31; *242*: XVI, 27; *245*: XVI, 1; *247*: XVI, 13; *250*: XIII, 11; *251*: XVI, 17; *252*: IX, 1; *254*: XVI, 40; *255*: XX, 9; *256*: XVI, 5; *257*: XX, 1; *258, 259*: XVI, 18; *260, 261*: XVI, 18; *271*: XIII, 2; *272*: XVI, 14; *273*: XIII, 2; *275*: XIII, 1; XVI, 34; *327 (110)*: XX, 11; *327 (113)*: XX, 12; *327 (122 a)*: cf. XX, 11; *s.n.*: IV, 1; IX, 1; XIII, 6, (2); XIII, 20; XIV, 1; XVI, 18; XVI, 31; XVIII, 1 — Kramer *7*: VI, 1; *334*: XVI, 29 — Krukoff *4363*: XX, 11; *4434*: XIII, 20 — Kuhl & van Hasselt *55*: XIII, 12; *63*: XVI, 17; *64*: XVI, 8; *65*: XVI, 1; *67*: XVI, 5; *68*: XVI, 14; *72*: XVI, 14; *73*: XVIII, 1; *74, 75*: XIII, 12; *76*: VIII, 1; *77*: XVI, 29; *78*: XIII, 12; *80*: XVI, 39; *84*: XIII, 12; *153*: XIII, 11; *155*: XIII, 11; *193*: XVI, 31; *209*: XVI, 14; *211*: XVI, 39; *281*: XIII, 12; *s.n.*: XII, 1; XIII, 6, (2); XIII, 20; XVI, 30; XVI, 38; XX, 9 — Kuyper *B. 406*: I, 4.

Lam *565*: XVIII, 2; *2479*: XVI, 19, (1); *3025*: XVI, 13; *3067*: XVI, 6; *3068*: XVIII, 2; *3219*: XVI, 18; *3434*: XVI, 31 — Lam & Went *s.n.* (*herb. v. Steenis 1553*): XVIII, 1 — Lauterbach *119*: XIV, 1; *291*: XIII, 12; *417*: XVIII, 2; *1341*: XVIII, 2; *2246*: XIII, 20; *2730*: XIII, 12; *3031*: XII, 1 — Lawes *s.n.*: XIV, 1 — Ledermann *6853*: XIII, 20; *7004*: XIII, 3; *7139*: XVIII, 2; *7958*: XIII, 12 — Leefmans *102*: XX, 1; *133*: XIII, 1; *135*: VIII, 1; *s.n.*: XVI, 1 — Lehmann *19*: XIII, 12; *s.n.*: XII, 1; XIII, 3; XIII, 6, (2) — Leschenault *s.n.*: VI, 1; XIV, 3 — Lesson *103*: XIII, 6, (2) — Lete *223*: VI, 1 — Lewandowsky *13*: XIII, 12 — Lobb *s.n.*: VI, 1 — Loher *4125*: XIII, 1; *4126, 4127*: XIII, 1; *4128*: XIII, 1; *4129*: XIII, 1; *4130*: XIII, 12; *4131, 4132*: XIII, 12; *4133*: XIII, 12; *4139*: XIV, 1; *4140*: XIV, 3; *4156*: XIV, 3; *4159*: XIII, 3; *4160*: XIII, 3, (1); *4161*: XIII, 3; *4164*: XIII, 6, (2); *6580*: XIII, 11; *6588*: XVI, 1; *6687*: XIII, 3, (1); *7281*: VIII, 1 — Lörzing *251*: VI, 2; *400*: XVI, 38, (1); *410*: XVI, 14; *588*: XIII, 11; *805*: XIII, 6, (2); *979*: XVI, 14; *1001*: XVI, 18; *1427*: XVI, 6; *1689*: VIII, 1; *1693*: XX, 1; *1699*: XVI, 36; *3075*: XVI, 10; *3162*: XVI, 36; *3255*: IX, 1; *3273*: XVI, 18; *3296*: XII, 1; *3299*: XIII, 2; *3300*: XVI, 18; *3330*: XIII, 6, (2); *3374*: IX, 1;

3386: XIII, 2; *3504*: XVI, 36; *3518*: XIII, 6, (2); *3519*: XIII, 11; *3521*: XX, 9; *3529*: XVI, 8; *3530*: XIII, 12; *3531*: XII, 1; *3572*: XIII, 12; *3598*: XIII, 20; *3674*: XVI, 19, (1); *3698*: XIII, 12; *4113*: XVIII, 1; *4149*: XX, 9; *4182*: XX, 8; *4208*: XIII, 6, (2); *4234*: XIII, 13, (2); *4263*: VI, 1; *4347*: XX, 8; *4392*: XX, 8; *4484*: XII, 1; *4723*: XIII, 13, (2); *5074*: XX, 8; *5358*: XX, 8; *5366*: XX, 8; *5535*: XVI, 18; *5713*: XVI, 18; *6174*: III, 1; *6521*: III, 1; *6934*: XVI, 19, (1); *7655*: XVI, 14; *7761*: XIII, 3; *7836*: XVI, 12; *7885*: III, 1; *7924*: XX, 11; *8085*: XIX, 1; *8094*; XVI, 5; *8095*: III, 1; *8514*: XX, 7; *8561*: III, 1; *8731*: XX, 7; *8826*: XVI, 14; *8964*: III, 1; *9001*: XVI, 1; *9008*: XIII, 11; *9199*: XVI, 19, (1); *9434*: XX, 7; *9578*: XIII, 12; *9612*: XIII, 6, (2); *9618*: III, 1; *9638*: XIII, 12; *9860*: III, 1; *10190*: XIII, 12 — Lörzing & Jochems *7532*: XIII, 20 — Lütjeharms *3602*: XIII, 20; *3838 C*: XIII, 12; *4419*: XIII, 20; *4682*: XVI, 13; *4698*: XVI, 19, (1); *5141*: XVI, 19, (1); *5143*: XVI, 13; *5361*: XVI, 12; *5379*: XVI, 18; *5407*: XVI, 30.

Macfarlane *s.n.*: XIV, 1 — McGillivray (Rattlesnake) *s.n.*: III, 1 — Mahlmeister *6*: XIII, 6, (2); *8*: XVI, 8; *25*: XVI, 39 — Mailander *26*: XIII, 12 — Maingay *1146*: XIII, 6, (2); *1147*: XIII, 6, (1); *1149*: XIII, 12; *1152*: V, 2; *1153*: V, 2 (1); *1953*: V, 2, (1); *1953 A*: V, 2, (1); *1973 A*: V, 2; *1973 B*: V, 2; *2951*: XIII, 6, (1); *2966*: XIII, 12; *3067*: XIII, 6, (2); *s.n.*: IX, 1 — Matthew *s.n.*: VIII, 1; XIII, 3; XIII, 12 — Van der Meer Mohr *5*: XVI, 19, (1); *32*: XVI, 39; *88*: XVI, 39 — Merliman (Cantley) *s.n.*: V, 2 — Merrill *47*: XVI, 23; *83*: XIII, 6, (2); *89*: XVI, 29; *93*: XIII, 12; *94*: XVI, 14; *206*: XIII, 11; *241*: XII, 1; *286*: XVI, 5; *298*: XIII, 1; *326*: XVI, 8; *334*: XVI, 19, (1); *357*: XVI, 8; *413*: XVI, 13; *420*: VIII, 1, (1); *447*: XIII, 12; *475*: XIII, 3; *538*: IV, 1; XIV, 1; *540*: VIII, 1; *618*: IV, 1; *620*: XIV, 1; *644*: XIII, 1; *650*: XIV, 1; *698*: XIII, 20; *733*: XIII, 11; *827*: XIII, 12; *830*: XIII, 6, (2); *1266*: XII, 1; *1268*: XIII, 6, (2); *1270*: XIII, 6, (2); *1440*: XIII, 1; *1665*: XIII, 20; *2048*: XIII, 12; *3105*: XIII, 6, (2); *3398*: XIII, 2; *3419*: XIII, 2; *3615*: XIII, 3, (1); *4270*: XVI, 1; *5040*: XIV, 3; *5163*: XVI, 5; *5167*: XIV, 1; *5171*: XVI, 10; *6300*: XIII, 11; *7129*: XVI, 31; *7403*: XIII, 12; *9185*: XIII, 11; *9458*: IX, 1; *11611*: XIII, 22; *c.*: XIII, 3 – Merrill, Spec. Blanc. *105*: XVI, 19, (1); *177*: XVI, 27; *281*: XVI, 5; *292*: XVI, 8; *306*: XVI, 12; *357*: XIII, 5; *392*: XVI, 31; *427*: XVI, 18; *459*: XVI, 10; *513*: XVI, 30; *554*: XIV, 1; *679*: XIII, 3, (1); *698*: XII, 1; *738* (*Topping*): XIII, 22; *794*: XVIII, 1, (2); *822*: VIII, 1; *952*: XIII, 20; *1051*: XVI, 39 — Meyer *s.n.*: VIII, 1 — Micholitz *s.n.*: VI, 1 — Millet *s.n.*: VI, 1; XIII, 6, (2); XIII, 11; XIII, 12 — Milne *s.n.*: I, 1 — Md. Nur *s.n.*: VI, 1; VIII, 4; XIII, 3; XIII, 6, (2); XIII, 12; XVI, 23 — De Monchy *151*: XX, 1; *s.n.*: XIII, 6, (2); XVI, 27 — Mondi *40*: XVI, 31; *137*: XVI, 35; *199*: XIII, 6, (2) — Moseley *s.n.*: XII, 1 — Moszkowski *233*: XIII, 20; *369*: XIII, 2 — Motley *175*: VI, 1; *231*: XIII, 12; *233*: XIII, 2; *310*: XIII, 11; *546 bis*: XIII, 12; *606*: XII, 1; *892*: XIII, 3; *931*: XIII, 6, (2); *1209*: V, 1 — Mousset *285*: XVI, 1; *286*: XVI, 6; *436*: XIII, 1; *570*: XVI, 14; *786*: VIII, 1; *813*: XII, 1; *877*: XX, 9.

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THE RELATION BETWEEN TAXONOMY AND CHEMISTRY OF PLANTS

by

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The first question in this field of science is: can we say, that there is actually any relation between taxonomy and chemistry of plants? Nearly a century ago the worker in chemistry Rochleder (10) attempted to show the possibility of this relation and called that branch of science phytochemistry.

To begin with, something must be said about the products in question. Glucose, sucrose, several aminoacids and other acids are, of course, left out of account. Only those chemical products, which are more or less specific and characterise larger or smaller groups of plants are considered here.

Is there really any relation between the chemical nature of these products and the taxonomical position of the plant by which they are formed? This is not a matter of course; since Linnaeus constructed his first so-called natural system, the systems were always based upon comparison and valuation of morphological characteristics: form and construction of different organs, especially those which are concerned with sexual propagation.

In the taxonomy of the Cryptogams some morphological characteristics are used, which can easily be transferred into chemical ones. A classification in Bluegreen, Red, and Brown Algae, which still has its right of existence, only means the formation of certain coloured chemical products. The classification of the Cormophytes however, seems at first sight to show not the least relation between chemistry and taxonomy; only form and structure are decisive here. Although historically explainable this is rather illogical.

Form and structure are, as it were, a function of a higher order than the formation of chemical products but they are founded on properties, which possess the closest connection with metabolism.

Workers in this field of science who, following the track of Rochleder, lay stress upon this connection of chemistry and taxonomy, are not rare. One of them is the Russian botanist Sergius Ivanow (3) who in the year 1926 gave us his so-called biochemical laws, which may be briefly formulated as follows:

1°. Each species growing under the influence of normal external factors is able to produce its characteristic products, which Ivanow calls the physiological characteristics of this species.

2°. Each species has these physiological characteristics in common with the species, which are in genetical connection with it.

3°. If this connection is more distant new products arise, which have a simple chemical relation with the basal products from which they originated.

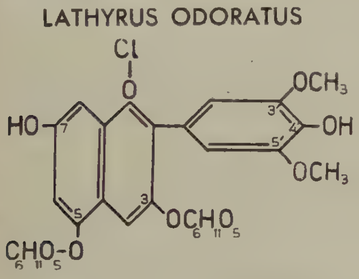
4°. These physiological characteristics are liable to evolution.

In my opinion it is incorrect to call a chemical product a physiological characteristic; the ability to form the product may be regarded as such. Setting this aside, the question remains whether these laws of Ivanow are correct or not.

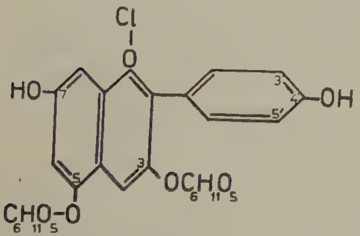
Two ways are open to put these laws to the test: the first is to consider whatever genetics teach us about the chemistry of newly originating mutations and their crosses with the mother-species. A second way is offered by a careful comparison of the chemistry of higher plants, especially in relation to their place in the botanical system.

As to the first point, data are almost entirely lacking; although genetics has often studied loss or formation of a chemical product, usually a coloured one, the chemical nature of these products in detail has rarely been taken into consideration. A happy exception, however, is formed by a group of English workers, who attempt to link up pigment chemistry with information on genetic factors, controlling colour variations in higher plants.

From a paper by Rose Scott Moncrieff (11) I cite some particulars about changes in the chemistry of flower pigments, observed in mutations of *Lathyrus odoratus*, *Primula sinensis* and *Rosa Polyantha*.



Malvidin 3.5′ dimonoside



Pelargonidin 3.5′ dimonoside

Fig. 1.

Anthocyanins are glycosides, formed by the combinations of one or two molecules of hexose or pentose with an aglycone called anthocyanidin. Variations in these anthocyanidins occur, owing to hydroxy- or oxymethyl-substitutions in the so-called side-phenylring. In the main form of *Lathyrus odoratus* e. g. one finds the malvidindimonoside with two hexose-molecules and with two OCH_3- and one OH-group in the side-phenylring. By mutation a peonidindimonoside originates, in which one OCH_3-group is lost. By further mutation in this direction the second OCH_3-group also disappears and pelargonidindimonoside is produced.

Rosa Polyantha gives an example of the contrary: from the main form, containing a pelargonidinrhamnoglycoside with only one OH-group, a mutation originates containing cyanidinrhamnoglycoside, which possesses two OH-groups in the side-phenylring.

The variations in the number of OCH_3- or OH-groups are interesting because similar differences exist between alkaloids in different species. The genus is characterised by a combination of alkaloids of one and the same type whilst the species of this genus have characteristic variations of this type, differing e. g. in the number of OCH_3- or OH-groups.

Greater chemical changes are to be found in plants with volatile oils: e. g. *Thymus Serpyllum* is characterised by a mixture of volatile oils with the benzenederivatives thymol or cymene as principal product, whilst *Thymus Serpyllum* var. *citriodora* contains volatile oil in which the aliphatic terpene citral dominates.

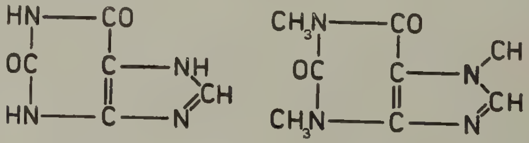
The above mentioned facts consequently show a close connection between the chemistry of a species and its genetical constitution.

Considering the question from another point of view we can pay attention to the chemical products in the subdivisions of the Cormophytes. We are then struck by the following: in mosses alkaloids, glycosides and volatile oils (from special glandular cells) are lacking; in Vascular Cryptogams alkaloids and glycosides are also lacking, whilst volatile oils may be present. Considering the situation in seedplants we note the presence of volatile oils and glycosides in Gymnosperms, whilst alkaloids are almost entirely lacking here. In Angiosperms however these three groups of chemical compounds are widely distributed, but in Sympetals their presence is more general than in the other groups. Generally speaking, the higher the place in the taxonomical system, the more complicated the chemistry.

American workers, especially McNair (7) tried to work out this problem and to use the chemistry of the species as an indicator of the place which species and genera containing these products occupy in the system. Underneath I hope to explain his methods more in detail.

Now the question arises: Are there no objections to the biochemical laws of Ivanow? Indeed there are: besides products which are formed everywhere in metabolism there are on the one hand a great number of chemical compounds which are only to be found in one single group of species and may be said to typify it. On the other hand, however, a small number of products exists, which are likewise present in several genera, but in genera of a completely different morphological structure and belonging to quite different parts of the tribe of Angiosperms. As an example of these compounds I may cite the alkaloid caffeine, the indigo-glycoside indicoside and the aromatic product eugenol.

Caffeine is to be found in *Centrospermae*, *Columniferae*, *Gruinales*, *Parietales* and *Rubiales*, in each case in one single genus or in only some species of one genus.



Xanthine

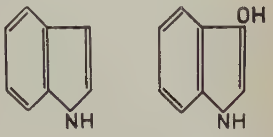
Caffeine

Fig. 2.

Indicoside is present in some species of the *Polygonales*, *Rhoeadales*, *Leguminosae*, *Contortae* and *Synandrae*, whilst eugenol is met with in e. g. *Coniferae*, *Myrtales*, *Gruinales* (*Burseraceae*), *Tubiflorae* (*Labiatae*) and *Scitamineae*, again in one single genus or some species of it.

It is evident, that this fact is contrary to the biochemical laws of Ivanow and at the same time it seems to be a decisive argument against the considerations of phytochemistry, which so closely connect the chemistry of a species with its place in taxonomy.

Do these products as caffeine, indicoside and eugenol possess pecularities which distinguish them from the chemical compounds characteristic for a single and strictly limited group? This, indeed, is the case and the difference is that the former have a close connection with ubiquitous metabolic products.

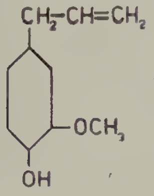


Indol Indoxyl

Fig. 3.

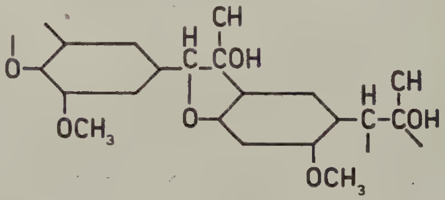
Caffeine or trimethylxanthine is closely connected with xanthine itself and the latter is an ubiquitous product of nucleoproteidmetabolism.

The aglycone of indicoside is indoxyl, which has a close connection with indol and tryptophane, both products of protein metabolism.



Eugenol

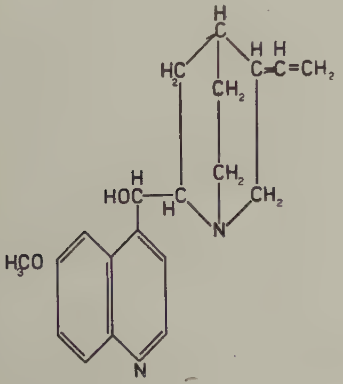
Fig. 4.



Lignin

Fig. 5.

Eugenol may be connected with lignin (15), a compound which characterises lignified cellwalls. In the case of lignin I must remark, that such aromatic terpene compounds are only met with in those divisions of the vegetable kingdom, in which lignified cellwalls are present (Vascular Cryptogams and Spermatophytes). Moreover the formation of such glandular products always takes place in connection with the cellwall (5).

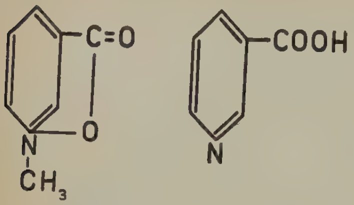


Quinine

Fig. 6.

In contrast with the above mentioned products as caffeine c.s., which are closely connected with ubiquitous metaboles, this is not the case with compounds as strychnine or quinine, which characterise definite genera. It would lead us too far, to treat this in detail, but a glance at the formula of quinine makes it clear. Quinine can only be built up by a series of mutations, whilst a product as caffeine with its wide dispersion in the Angiosperms may have originated from an ubiquitous metabole by one single mutation.

It is evident, that one single mutation may have taken place more than once and in different parts of the genealogical tree, whilst it may be called exceedingly improbable that the same series of mutations should repeat itself twice.



Trigonelline Nicotinic acid

Fig. 7.

One fact seemed to militate against the hypothesis that those alkaloids, which are most widespread, ought to be the most easily derived from generally occurring products of protein metabolism, i. e. that trigonelline is the alkaloid of the most widespread occurrence [1]), as this is the betaine of nicotinic acid or pyridino-carbonic acid and neither this nor pyridine itself were known to be common products of metabolism.

Experiments however of Warburg, Christian and Griesen (14) have come to prove that the coferment of dehydrases is an amido-derivative of pyridine, which through hydrolysis yields nicotinic acid, in which connection it should be remembered that trigonelline as I have already said above, is the betaine of nicotinic acid. As cozymase is also a nucleotide containing nicotinic acid, we may say that trigonelline can be derived in a straightforward way from a common product of metabolism.

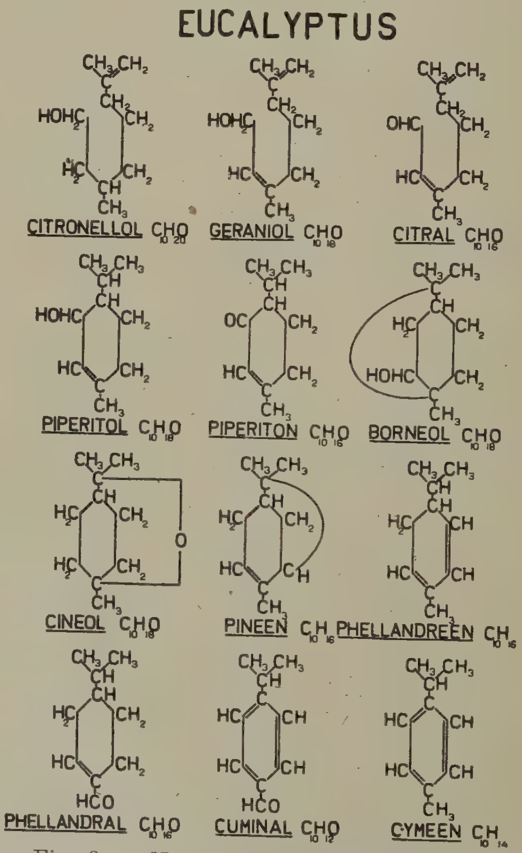


Fig. 8 — Note. For piperiton, pineen, phellandreen, cymeen, read: piperitone, pinene, phellandrene, cymene respectively.

The conclusion is, that the laws of Ivanow are not valid for compounds which have a close connection with ubiquitous products; in other words, these compounds are not typical for the taxonomical position of the species containing them.

More may be said about the fundamental facts of phytochemistry but for this it is necessary to enter somewhat more into detail as to the methods of taxonomy in classifying species. Usually not a single characteristic but a combination of them is taken into consideration. To be fair the same treatment ought to be followed in considering the taxonomical value of chemical compounds. Not one single product but a combination of products has often to be used as a characteristic (16).

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[1]) Trigononelline is found in 18 different families, caffeine, the next alkaloid for widespread frequency, in only 6 families.

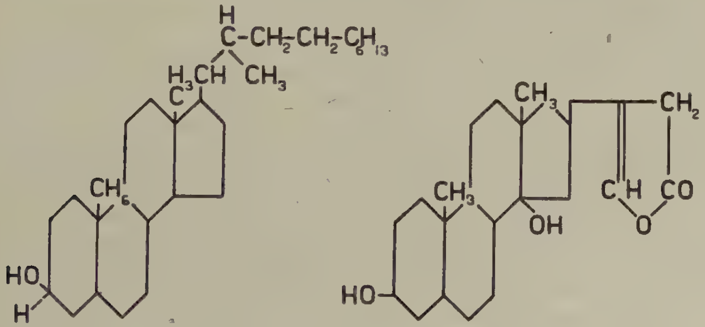
In doing this we note, that at one blow everything has changed. Cineol e. g. is present in a number of approximately 40 families belonging to quite different branches of the Angiosperms: *Labiatae, Compositae, Myrtaceae, Zingiberaceae,* etc. but a definite combination of volatile oils with cineol as main constituent completely characterises the genus *Eucalyptus.* As appears from an accurate study by Baker and Smith (1) of the volatile oils of this large Australian genus, the combination of chemical compounds in detail is different in each species. This is due to the fact, that besides cineol the Eucalypts may contain pinene, phellandrene, geraniol, citral, cymene, terpinene etc., in all some 20 different compounds, variously combined.

The same may be said for the volatile oils of the genus *Pinus,* in which pinene is everywhere present.

The alkaloid protopine is met with in nearly all *Papaveraceae,* but each genus and perhaps each species has its own characteristic combination of alkaloids. These alkaloids are derived from the products of protein-metabolism tyrosine and dioxyphenylalanine and the same is the case with the alkaloids of several other groups of plants. But the alkaloids of the *Papaveraceae* are derived in a special way and are present in a combination which is nowhere else to be met with.

The combination of these alkaloids again differs in the different parts of the family. The *Fumaroideae* with their zygomorphic flowers and their stamens united into two bundles, present a combination of isochinoline derivatives different from the one which characterises the *Papaveroideae* with their actinomorphic flowers and free stamens. The genus *Corydalis* contains a combination with differs from that found in the genus *Fumaria.*

As a last example I cite the plants with the glycosides, notorious for their action on the heart, e. g. *Digitalis* spec. div. (*Scrophulariaceae*), *Strophantus (Apocynaceae), Adonis vernalis (Ranunculaceae), Convallaria majalis* and *Urginea Scilla (Liliaceae).*



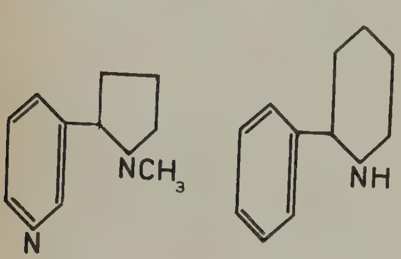
Sitosterine Digitoxigenine

Fig. 9.

Of late years, our knowledge of these compounds has advanced enormously by the work of Windaus, Tschesche (13), Jacobs (4) and others; it has been found that these glycosides bear a great resemblance to each other as regards their chemical composition.

The aglycones digitoxigenine and gitoxigenine from *Digitalis,* and cymarigenin from *Strophantus*, are composed of 23 C-atoms and the structure proved to be a complex carbon-system of 3 six-rings, one five-ring and a lacton-ring. The structure bears a close resemblance to that of the sterines, compounds which seem to occur in every plant cell as well as in the animal cells. Still the structure in detail is different in each genus, often in each species. Not only the aglycones but also the carbohydrates which take part in the constitution of the natural glycosides may differ.

I might continue in this manner, but I prefer to treat some cases, which at first sight seem to tell against this phytochemical maxim, that each genus and perhaps each species has its own combination of chemical compounds.



Nicotine Anabasine

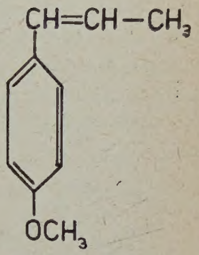
Fig. 10.

As for the alkaloids I take nicotine, which till lately was considered as typical for the genus *Nicotiana.*

From the species *Nicotiana Tabacum* the worker in chemistry Pictet (9) had isolated besides the main alkaloid nicotine a small number of so-called secondary alkaloids, which are present in very small quantities; in other genera this type of alkaloid was unknown. A few years ago, however, an alkaloid was isolated from *Anabasis aphylla,* a *Chenopodiaceae* from Asia Minor, whose chemical properties so much resembled those of nicotine, that at first sight they were supposed to be identical. Afterwards this proved to be incorrect; anabasine, the alkaloid from *Anabasis,* is built up by coupling two pyridine-rings, one hydrogenated, one not, whilst nicotine is built up by coupling a hydrogenated pyridine-ring with methylpyrrolidine. One of the secondary alkaloids of *Nicotiana Tabacum,* which is the main alkaloid in *Nicotiana glauca,* is, however, identical with anabasine (12). In these two quite different branches of the Angiosperms the same alkaloid is met with, the combination of alkaloids is, however, quite different; in *Anabasis* e. g. lupinine is found, an alkaloid which in *Nicotiana* is lacking.

A second example is taken from the glycosides: in the woods of the eastern part of the United States two species are met with from which the odoriferous compound methylsalicylate can be obtained. These species are: *Betula lenta,* a kind of birch, and the evergreen shrub *Gaultheria procumbens,* belonging to the *Ericaceae.* Both plants contain the glycoside gaultherin, which by enzymatic action of gaultherase gives methylsalicylate. Tracing the combination of typical products in both species it appears that in *Gaultheria procumbens* gaultherin is combined with the glycoside arbutin, which is typical of a great number of *Bicornes. Betula lenta,* on the other hand, contains no arbutin and whilst the volatile oil from *Gaultheria* is optically active, that from *Betula lenta* is optically inactive. Here too, at first sight a complete agreement in chemistry seemed to exist, whilst a further investigation showed us the incorrectness of it.

A third case is taken from plants with volatile oils: *Pimpinella Anisum,* belonging to the *Umbelliferae* takes its flavour and taste from the presence of the aromatic compound anethol, which is also met with in other *Umbelliferae* (note the resemblance of anethol to the formula of lignin), e. g. fennel, *Foeniculum vulgare.* Now this anethol is also the main ingredient of the volatile oil from the magnoliaceous *Illicium verum,* belonging to quite another part of the Angiosperms. By examination of the products, which are present in both plants besides anethol, it is proved that the combinations are quite different: star anise, *Illicium verum,* contains traces of terpenes, which are lacking in the common anise.



Anethol
Fig. 11.

It is interesting to study in this respect the behaviour of caffeine a compound whose dispersion in the vegetable kingdom was quoted above as an argument against the laws of Ivanow. Is even this compound present in different combinations in the genera containing it? The question must be answered in the affirmative:

1⁰. *Coffea* (*Rubiaceae*) : caffeine main alkaloid, trigonelline secondary alkaloid;
2⁰. *Thea* (*Ternstroemiaceae*): caffeine main alkaloid, theophylline, theobromine and monomethylxanthine secondary alkaloids;
3⁰. *Cola* and *Theobroma Cacao* (*Sterculiaceae*): theobromine main alkaloid in the latter, caffeine secondary alkaloid, whilst in *Cola* the reverse is the case;
4⁰. *Ilex* (*Aquifoliaceae*): only caffeine present in some species of this genus;
5⁰. *Paullinia* (*Sapindaceae*): caffeine main alkaloid in the seeds, theobromine in the leaves.

Even if we only pay attention to the alkaloids, the combination is different in the genera containing these xanthine derivatives.

In short, each genus, often each species has its specific combination of these chemical compounds. A classification along these lines is often analogous to the usual classification on a morphological base.

The objection might be made, that a number of families exist in which no alkaloids or glycosides are present. Volatile oils have a much wider dispersion: even in plants in which glandular cells are lacking, compounds are produced, which give flavour to plants or flowers. Smell and taste, senses which are practically incapable of analysis but possess an acute perception of the whole, often notice small differences by which one species is distinguished from the other. Consider the scent of flowers, often insufficiently analysed in chemical respect, but so characteristic for a species. Consider the difference in taste and smell of our vegetables;

even varieties of the species *Brassica oleracea*, possess obvious differences, besides much they have in common.

And still there are products which have been left out of consideration and which are probably nevertheless the most characteristic ones, viz. the proteids.

The difficulty is, that with our usual chemical methods we are not able to distinguish these different proteids, only some groups are distinguishable. Other methods are therefore used but their value is not generally acknowledged. I mean, of course, the methods of serology. By means of these whole genealogical systems have been constructed, based on the supposed chemical properties and affinities of these proteids, but critics of these methods have practically exploded them. Only a few principles of serology can be mentioned here; to enter into detail would lead us too far.

The main principle is, that definite products brought into the blood circulation of any mammal, e. g. a rabbit, cause these organisms to produce compounds which are able to check the damage caused by injection of the solution.

The injected compound is called an antigen and the whole serum-diagnosis is founded on the principle, that these antigens have a specific action. In constructing a genealogical tree with the aid of these antigens it is assumed that:

1°. each species produces compounds which are able to act as antigens;
2°. the more these antigens differ, the further removed from each other in the genealogical system are the species which produce them.

In the opinion of Mez (8) these antigens are proteids of the nucleus, especially from the chromosomes, a supposition which might account for their specific pecularities and properties. The supposition may be correct but the methods by which the antigens are extracted from plant tissues do not furnish the least proof of the hypothesis that the chromosome-proteids are present in the above mentioned solutions.

If a solution of such an antigen is injected into a rabbit an antibody is formed in the blood, which immunises the animal. This antibody can be isolated and gives a precipitate with the antigen. It is, however, questionable, whether the last-named reaction may be called speciifc; in other words, does a solution of the antibody under the required circumstances give a precipitate with the antigen obtained from this one species (and eventually the species closely allied with it), whilst no precipitate is obtained with the antigen from other species? Suppose that the latter is really the case; then the question arises: is it possible to judge the degree of affinity by the degree of intensity of the reaction? It is evident that a multitude of questions arises, which renders the diagnostic value of the whole of serology highly problematic.

With a high degree of probability it may, however, be maintained that each species has its own specific chemical compounds; for many genera the same holds good. It is also obvious for a number of families e. g. *Cruciferae, Papaveraceae, Umbelliferae, Labiatae*, etc.; whether it is true for all families has still to be ascertained.

In this connection I wish to say something about the work of the American botanist McNair (6). The latter has studied families with alkaloids, glycerides or volatile oils in reference to:

1°. the average molecular weight of the alkaloids;
2°. the average iodine value (indicator of the number of double bonds) of the glycerides);
3°. the average specific weight of the volatile oils.

McNair represents the evolutionary degree of the family by the index number which De Dalla Torre and Harms (2) have given to the families. By doing this McNair arrives at the following conclusions.

If we pay attention to families with species of the same climatic zone, the average chemical and physical properties of these families vary with the degree of evolution according to the classification of Engler and Gilg.

Putting it more precisely we can say: McNair maintains that the degree of evolution of a plantfamily is the higher:

1°. as the alkaloids possess a higher average molecular weight;
2°. the higher is the average iodine value of the glycerides;
3°. the larger is the specific weight or the lower the refractory index of the volatile oils.

Against this reasoning of McNair very serious objections may be brought forward:

1°. a pedigree can never be represented by a single line; the index numbers of De Dalla Torre and Harms are therefore wholly unfit indicators of the degree of evolution, even if we suppose that the classification of Engler and Gilg gives a fair representation of the development;

2°. whether glycerides with a higher iodine value are more complicated than those with only single bonds, is very doubtful; it is possible that on the contrary the glycerides with only single bonds are formed in metabolism from those with double bonds;

3°. the molecular weight of alkaloids depends on the ubiquitous product of metabolism from which they have originated, e. g. an alkaloid which can be derived from tryptophane (molecular weight 204) has, of course, a higher molecular weight than a derivative of proline (molecular weight 105), even if the latter is derived in a more complicated manner.

Although the work of McNair may claim the merit of drawing attention to the fact that the more closely plants are related, the more similar are their chemical products, his further considerations are to my thinking not of much value.

This, however, does not alter the fact, that a close relation exists between the nature of the chemical products and the taxonomical position of the species, genus or family which produce them. It is my intention to put the question whether each family has its own characteristic combination of chemical compounds produced in their metabolism, to the test; perhaps a better insight into the chemism of metabolism may thereby be obtained.

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